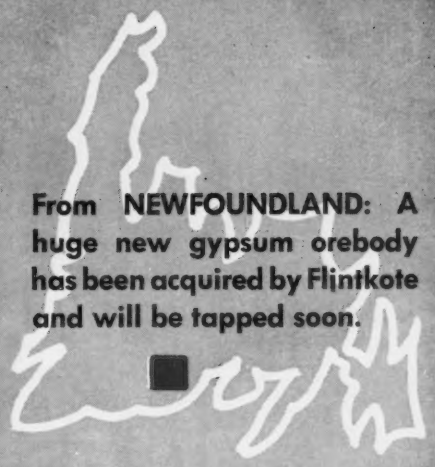
ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

AUGUST 1960

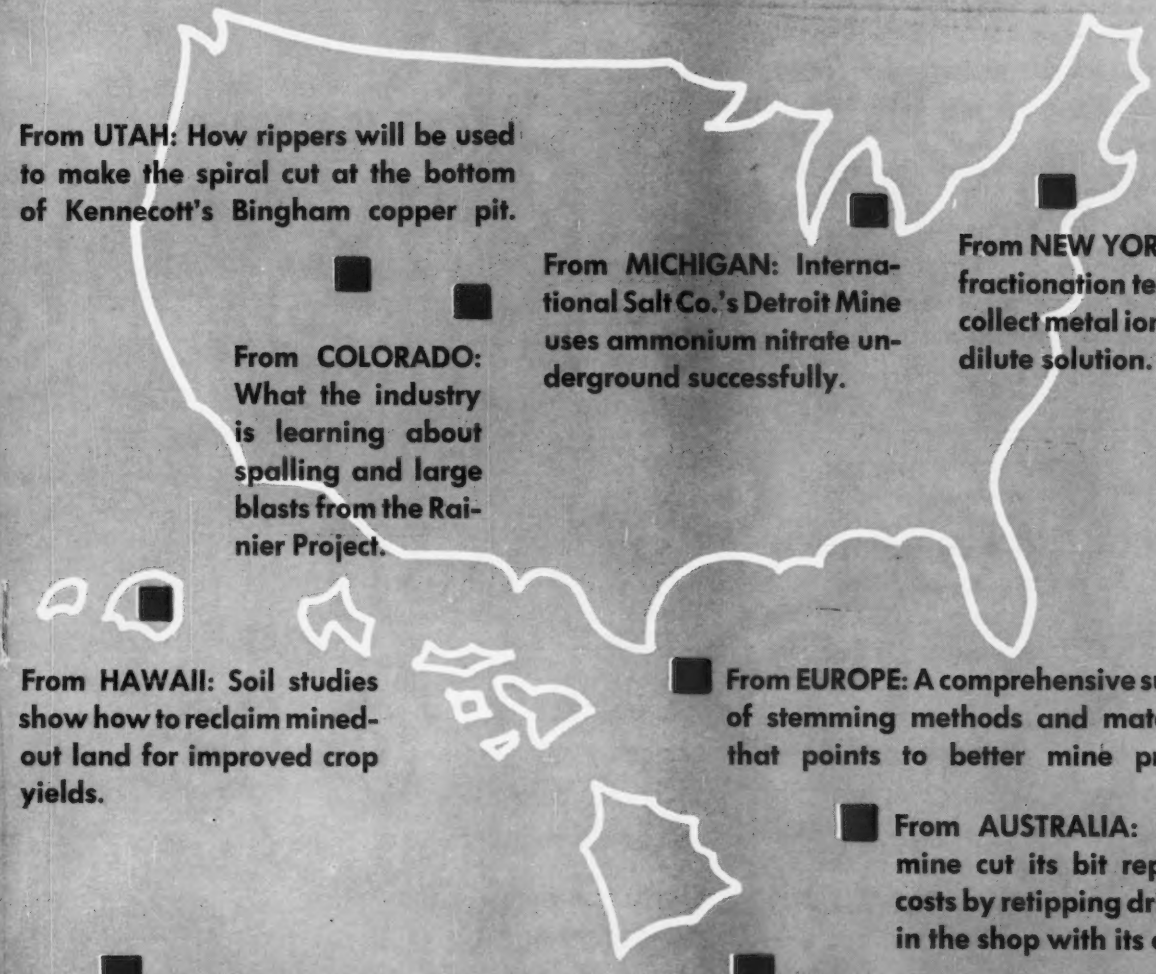
PRICE ONE DOLLAR

FOUNDED 1866



From NEWFOUNDLAND: A huge new gypsum orebody has been acquired by Flintkote and will be tapped soon.

World-Wide Reports...



From UTAH: How rippers will be used to make the spiral cut at the bottom of Kennecott's Bingham copper pit.

From COLORADO: What the industry is learning about spalling and large blasts from the Rainier Project.

From MICHIGAN: International Salt Co.'s Detroit Mine uses ammonium nitrate underground successfully.

From NEW YORK: A foam fractionation technique to collect metal ions in a very dilute solution.

From HAWAII: Soil studies show how to reclaim mined-out land for improved crop yields.

From EUROPE: A comprehensive survey of stemming methods and materials that points to better mine profits.

From AUSTRALIA: How one mine cut its bit replacement costs by retipping drilling rods in the shop with its own staff.

From VENEZUELA: Orinoco's truck haulage philosophy pays off at the huge Cerro Bolivar iron ore mine.

From SOUTH AFRICA: Movable forms are used to construct a reinforced concrete headframe quickly and smoothly.

The A-S-H equation for pumping abrasives / corrosives

ENGINEERING LORE
based on keeping performance records of nearly every A-S-H pump sold.

+

FLEXIBLE DESIGN
Split-shell interchangeable rubber-lined pumps, for instance.

+

EXPERIENCE in APPLYING METALS and ELASTOMERS
to meet tough pumping conditions.

Greater PUMPING EFFICIENCY

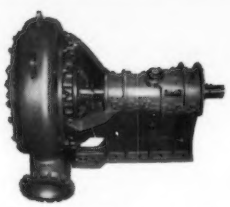
+

Lower OPERATING COSTS

Hydroseal & Centriseal split-shell interchangeable rubber-lined pumps are slurry and sand types.

Have we a secret that can be turned to good use for you? No one will ever know unless you tell us about your pumping problem. If it is in mining or in processing—metallurgical or chemical, write us.

THE ALLEN-SHERMAN-HOFF PUMP CO.
Dept. B—P.O. Box 635, Paoli, Pa.
Representatives throughout the World



Hydroseal all-metal sand and dredge pump for abrasives over ¼" diameter.

HYDROSEAL and CENTRISEAL
SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

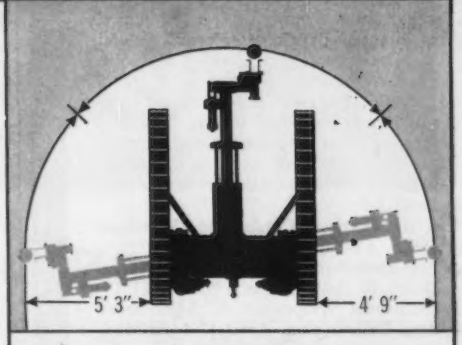
Unmatched versatility . . . drill boom is swung at right angles to tracks and drill carriage tilted inward for steeply sloped conditions.

The all new Chicago Pneumatic G-900 Tracdril is the culmination of 5 years of research and wide field experience. This self-propelled drilling unit is maneuverable, rugged and productive . . . a real *"drillers drill."* Extra large drilling radius because of its 180° horizontal boom swing and dual controls on turret and boom end for quick, accurate positioning of boom and drill carriage give the driller exceptional flexibility.
With the sensational 4½" Deep Hole Drill, it quickly sinks 3" holes up to 75 feet.

6 MAJOR EXCLUSIVES OF CP TRACDRILS

❶ **"Boarding house reach"** lets the drill carriage stretch out 63" beyond tracks to drill true verticals alongside the unit. ❷ **Extra-long Oliver tracks,** specially designed, provide stabilizing ground contact of 1350 square inches. ❸ **Sure-footedness and maximum traction** are assured with five lower track wheels. ❹ **Seven labor-saving hydraulic cylinders** ease driller's muscle work, give fluid-smooth action. ❺ **Two sets of grouped controls,** at turret and boom end, save time and steps for driller, boost footage. ❻ **"Dead man" automatic brakes** that slam on when tramming throttle is closed, locking unit on steepest slopes or bad ground.

NO EQUAL FOR DRILL PATTERN COVERAGE



- **Full 180° Ground Coverage . . . right or left. New G-900 drills true verticals at 90° angle to tracks.**
- Reaches "way-up" for extra high horizontal breast holes . . . to 11 feet.
- Big 85° carriage swing compensates for steeply sloped conditions.
- Keeps snake holes "way-down" and properly inclined . . . no interference from feed motors or crawler carriage structural members.

Full specifications and details in Bulletin SP-3627

Chicago Pneumatic

8 East 44th Street, New York 17, N. Y.

AIR COMPRESSORS • PNEUMATIC AND ELECTRIC TOOLS • AIR-BLAST BITS • DIAMOND DRILLS • REICHdrills • ROCK DRILLS

Mining Calendar

Annual assessment work ($100 worth of work per claim per year) must be initiated by Sept. 1, 1960

Sixth Annual Titanium Metallurgy conference, New York University (Heights campus), New York, Sept. 12-13

International Mining Congress, Hungarian Mining & Metallurgical Society, Budapest, Sept. 12-18

National Mineral-Metallurgical Days, Association of Mining Engineers of Spain, Marques de Santa Cruz 14, Oviedo, Oct. 3-8

Rocky Mountain Minerals Conference, Salt Lake City, Oct. 5-7

"Third Quinquennial Alumni Reunion," Minnesota School of Mines & Metallurgy (E. P. Pfleider, University of Minnesota, Minneapolis 14), Oct. 7-8

American Mining Congress, annual meeting, Las Vegas, Nev., Oct. 10-13

Symposium on Surface Mining Practices, University of Arizona College of Mines, Tucson, Oct. 17-18

Tenth Annual Symposium on Production Drilling & Blasting, Colorado School of Mines (Prof. L. J. Parkinson), Golden, Oct. 17-19

Metallurgical Society, fall meeting, Sheraton Hotel, Philadelphia, Oct. 17-21

New Mexico Mining Assn.-Southwest International Mining Assn. annual meeting, La Fonda Hotel, Santa Fe, Nov. 3-5

Electric Furnace Conference, Morrison Hotel, Chicago, Nov. 30-Dec. 2

AIME annual meeting, Chase-Park Plaza Hotel, St. Louis, Feb. 19-23, 1961

International Symposium on Agglomeration, Philadelphia, April 12-14, 1961

Coming Up

In September—The pre-show issue for the annual meeting of the American Mining Congress in Las Vegas. E&MJ's expanded New Products Digest will highlight what's new in equipment. The issue will also be your guide to the show and the meeting.

Beryllium—Exploration is speeding up, new processes are being studied; what's the forecast? The editors have surveyed all fronts for the long- and short-range answers.

Iron ore—Scrubbing, once the basic process on the Mesabi, is returning. A pilot plant is being operated by Cleveland-Cliffs, and the results of the tests indicate that looking back can be profitable.

94th YEAR OF PUBLICATION

ENGINEERING AND MINING JOURNAL

AUGUST 1960

A McGRAW-HILL PUBLICATION

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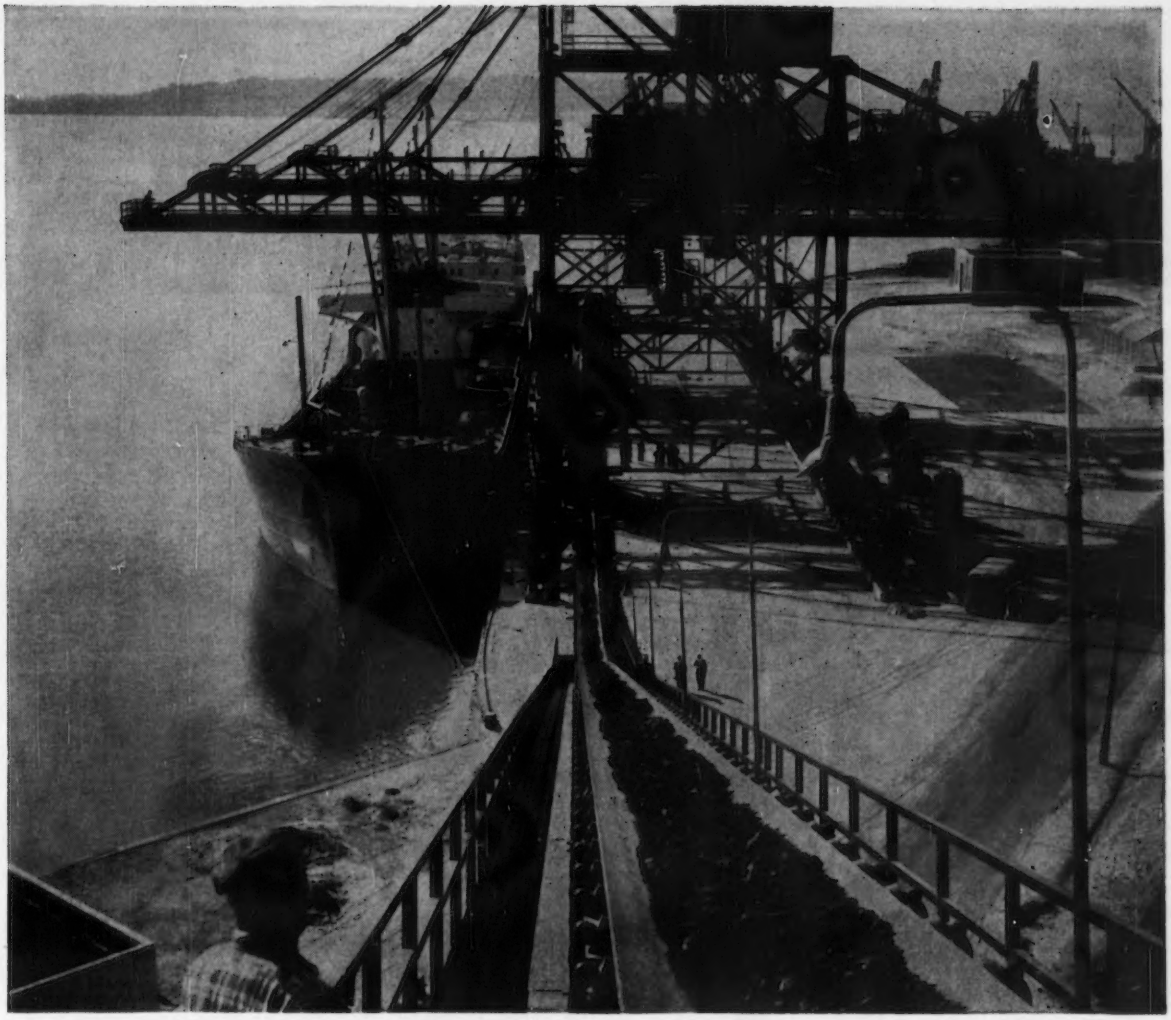

Belt gets up and goes— unloads ore ships in a hurry

After 9 million tons, B.F.Goodrich belt still going strong

At this pier, iron ore is unloaded from ocean-going freighters at a 2000-ton-an-hour clip. The conveyor belt rushes it up to waiting railroad cars. The whole system works so well that even the largest ore-carrying vessels can be emptied in less than 24 hours.

To stand the heavy loads, the speed, and to insure continuous operations, the engineers in charge selected a B.F.Goodrich conveyor belt. Special chemicals, developed by BFG, were added to the rubber to keep the belt "live" and elastic, help it resist the effects of air, sun, weather. Patented layers called "breakers" were built into the belt to increase impact resistance.

The trouble-free performance of the B.F.Goodrich belt has helped make this B & O Pier, Curtis Bay, Maryland, one of the biggest, fastest and most efficient ore-handling facilities on the East Coast. And after carrying nine million tons, the BFG belt is still in good condition.

But good as this record is, chances are that it will soon be bettered because of the improvements that are constantly being made in B.F.Goodrich belts. In recent years, for example, the use of improved rubber compounds and stronger fabrics has resulted in belts that can carry heavier loads farther and faster than ever before, and last longer doing it.

B.F.Goodrich distributors have full information on the belt described here. And, as factory-trained specialists in rubber products, they can answer your questions about the many rubber products BFG makes for industry. *B.F.Goodrich Industrial Products Co., Dept. M-906 Akron 18, Ohio.*

B.F.Goodrich

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ENGINEERING AND MINING JOURNAL

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82 **The Siemcrete System—A New Way to Build Headframes**
Concor Construction Co. Ltd. built a reinforced concrete headframe for Zandpan Gold Mining Co.'s new 7,500-ft shaft in just 10 weeks time by using rigid, re-usable sliding units.

85 **The Kennecott Spiral—A New Drop-Cut for Bingham**
Morrison-Knudsen Co. is connecting the bottom of the Bingham Pit to an ore haulage tunnel by dropping a 150-ft spiral. The contractor will rip some 5-million tons of ore and remove it with carry-alls—a radical departure from present drop-cutting and mining methods.

86 **Stemming—A Practice That Pays**
A comprehensive survey of stemming materials and practices in Europe brings these conclusions: (1) The material is inexpensive. (2) The practice need not be time consuming. (3) You get better fragmentation with fewer blow-outs and misfires. (4) Less gas and dust is produced. (5) You need less powder. Also included is a report on new materials and practices as well as direct comparisons between the methods.

91 **Ammonium Nitrate—As Good Underground as Above**
The Detroit Salt Mine reports that their switch from dynamite to ammonium nitrate-fuel oil mixtures has been completely successful. Fragmentation is reported superior to dynamite and there is no excess carbon monoxide or oxides of nitrogen. The company also reports a considerable cost reduction —at 3½¢ per lb for ammonium-nitrate compared to 18¢ to 20¢ per lb for dynamite, the saving is obvious.

94 **Twelve Steps to Retip TC Drill Steel**
The Zinc Corp. Ltd. is putting new tungsten carbide inserts in all their used drill steel by using a technique based on a high temperature liquid salt bath. The retipped steel is equal in performance to new drill steel.

98 **Spalling and Large Blasts**
From the Colorado School of Mines Research Laboratory comes a report on how you can predict spalling. In the case of the Rainier nuclear blast, what happened to the rock 900 ft from the shot was entirely consistent with theory. From the shape of the wave and the fracture strength of the rock, you can determine the number of spalls and the speed and distance they move.

102 **How a New State Is Helping Itself**
Strip mining has often devastated the land on which it was performed. Hawaii, looking forward to a possible bauxite mining industry, authorized a year's study of revegetating mined-out areas. Here are the results.

SPECIAL REPORT TO CATERPILLAR OWNERS:

CAT CATERPILLAR

Parts you can trust
... cost less per hour

announcing...

BONDED BUY PARTS ASSEMBLIES

PARTS

BONDED BUY

ASSEMBLY

PARTS ASSEMBLY

Guarantee Bond

Know All Men by these Presents,

that_____

of_____(hereinafter called Seller),

is held and firmly bound unto_____

of_____(hereinafter called Buyer)

in the sum of not exceeding the lesser of FIVE THOUSAND DOLLARS ($5,000.00) or Seller's price, with respect to each parts assembly described below, for the payment of which Seller hereby binds itself, its successors and assigns by these presents.

The Condition of this Obligation is such that Whereas Seller has sold to Buyer the below-described parts assembly or assemblies originally manufactured by Caterpillar Tractor Co. and reconditioned in accordance with practices recommended by Caterpillar Tractor Co.:

DESCRIPTION	PART NUMBER	SERIAL NUMBER	SALE PRICE

And Whereas Seller guarantees each said parts assembly against unsatisfactory performance due to defective material or workmanship for_____days after the date of sale shown below (herein referred to as the guarantee period), the obligation under this guarantee being only to repair or replace, as Seller may elect, any said assembly which proves defective in material or workmanship under conditions of normal use during the guarantee period at Seller's expense (including cost of all necessary materials and labor) up to a maximum of the lesser of Five Thousand Dollars ($5,000.00) or Seller's price, with respect to each said assembly, except that the cost, if any, of transporting each said assembly from and to Seller's place of business shall be paid by the Buyer.

Now, Therefore, if Seller, its successors and assigns shall in all respects well and truly perform the obligation under the guarantee recited above, then this obligation shall be void; otherwise to remain in full force and effect.

THE ABOVE GUARANTEE IS VOID, AND SELLER SHALL BE UNDER NO OBLIGATION THEREUNDER, IF CLAIM IS NOT MADE TO THE SELLER WITHIN THREE (3) DAYS AFTER DISCOVERY OF THE DEFECT UPON WHICH THE CLAIM IS BASED.

You can have complete confidence in any Parts Assembly Exchange or Rebuilt Unit carrying the dealer's new Bonded Buy label. You'll receive a Guarantee Bond, backed by the Lumbermens Mutual Casualty Company of Chicago, Illinois, giving the guarantee conditions agreed upon at time of sale. This is further evidence that a Caterpillar Parts Exchange or Rebuilt Assembly is in first-class condition—another way of expressing the careful and thorough workmanship that goes into each of these reconditioned assemblies.

The cost? It compares favorably with the cost of doing the reconditioning work yourself. Often less . . . because of the availability of special equipment and servicemen's skills in the dealer's shop. Your final net cost is based on parts and labor necessary to put your worn assembly in A-1 condition—same as the exchange unit you receive.

Here's why Cat Reconditioned Assemblies save you money. You trade down time for more *go* time. Simply:

1. **Call your Caterpillar Dealer and arrange for the Parts Assembly you need.**
2. **Remove your worn assembly and install the reconditioned unit.**
3. **Put your machine back to work immediately and return the worn unit to your dealer.**

Any way you look at it, a Bonded Buy Parts Assembly is a good deal. You get a dependable unit . . . guaranteed in writing. The cost is approximately the same had you done the work yourself. Time saved can be converted to cash because your machine's working and earning. Contact your Caterpillar Dealer today. Find out what assemblies he stocks (new items are being added daily).

SERVICE TIP: Never allow your present machine components to become worn to the point where reconditioning is impossible.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

94 YEARS OF MINING

The following news items are reprinted substantially as they first appeared in the AMERICAN JOURNAL OF MINING, the publication which became *E&MJ*.

AUCKLAND, APRIL 1866—Travellers along the sea-shore of New Zealand have to wear veils to protect their faces and eyes from a fine metallic sand which rises with every puff of wind. This sand proves, upon analysis, to be the purest ore of iron known. Its composition is: peroxyd of iron, 88.45; oxyde of titanium with silica, 11.43; loss 12. Experiment shows that the ore yields in the furnace 75% of the best iron.

NEW YORK, MAY 1866 — The "Petroleum Company of West Virginia," in its advertisement published in an English paper, states that the 342 petroleum companies in America are paying dividends of from 4 to 20% per month upon the capital subscribed. This would be delightful news to the shareholders if there were but 4 to 20% of truth in it.

CALIFORNIA, JUNE 1866 — The Napa REGISTER notices a curious discovery at the head of Capel Valley: a ledge of white quartz, in which are cavities containing petroleum — a spoonful or so in a place—here and there imbedded in the solid rock. A company, called the Alladin Petroleum Co., has been formed for the purpose of prospecting.

ARIZONA, JUNE 1866—The Los Angelos STAR reports that M. Goldwater arrived from Arizona with about 500 ounces of gold dust, taken principally from the Linn's Creek and Weaver district placer mines. Also, a large quantity of gold from the celebrated Vulture. Mr. Goldwater also exhibited a quantity of silver bricks from the Patagonia silver mine, belonging to Mowry & Co.

CALIFORNIA, JUNE 1866 — The Amador LEDGER says the Belden mine is producing a large amount of gold. They have a little mill of five stamps, and with this they are crushing from four to five tons of rock per day, which yields, on the average, $110 to the ton.

This month in

ENGINEERING AND MINING JOURNAL

Continued from p4

Behind the By-Lines

It all started a few weeks ago, when we were asked to serve on an ad hoc committee. To prove that we're much longer on nerve than on brains, we agreed—and then promptly dashed to the dictionary to find what it was we'd agreed to. We came off much better than we deserved —and now have to serve on a committee with a specific charge; but a committee which is dissolved upon completing that charge. (We already knew enough to stay off standing committees!)

Our conceit was just about back into working shape when along came school superintendent Leo Rieman, of Werley, Idaho.

Mr. Rieman is concerned about the vanishing arrastras in this country, and sort of implied he'd like our help in restoring the one serviceable specimen he'd found at the old Dixie mine, southeast of Grangeville.—And did we panic?

Of course we did. But a quick sprint to Albert H. Fay's "Glossary of Mining Terms" saved us with the information that an arrastra is a not-quite-legitimate ancestor of the slusher, and originally was an "apparatus for grinding and mixing (gold) ores by means of a heavy stone dragged around upon a circular bed." Mr. Rieman's arrastra is circular, with a quartz or granite floor and walls of timber and granite.

You can imagine the shape we were in by the time the next issue of the KAISER BUILDER came out. That periodical, ordinarily a prime example of friendliness and good taste, came bouncing in and implying that we didn't know what a "cherry picker," "fast daughter," "skull," and "frisker" were. We had no trouble with cherry picker and skull, of course, but we had to suffer while they explained that a frisker is a detector on a doorway or floor plate to signal if a person is radioactively "hot." A fast daughter turns out to be not a teen-age vamp, but a second generation radioactive isotope with a short half-life.

Then we decided that two can play at the game. All right, KAISER BUILDER, if you're so bloomin' smart, take a crack at these samples of mine vernacular. What, for instance, is a:

go-devil	buzzy
bosh	coyote hole
jumbo	vug
widow-maker	kibble
single jack	long tom
cousin jack	tommy knocker
chippy doctor	high hangup
dipper stick	high grader
Chinaman	clean toe
pillar robber	broken back
boot-leg	clean face
grizzly	blister
muck stick	fast delay
winder	bunton
banjo	low light

Incidentally, if you've got anything else to do this afternoon, don't get to peering around in Mr. Fay's "Glossary." We did, and since the following gem was new to us, we couldn't fairly challenge our worthy opponents with it. But it's fast becoming our favorite:

"Keckle-meckle (Eng.) Lead minerals of the poorest quality. (See Kackle-meckle.)" Ain't that a pip?

Pre-Engineering by **KAISER ENGINEERS** answers basic plant expansion questions...

Raw Materials? Your final decision to expand or build results from a series of important individual decisions. Raw material availability is one of them. Independent analysis of all aspects of your proposed program is the *Pre-Engineering* service offered by Kaiser Engineers. In addition, KE is an experienced designer and builder of all types of facilities for the Minerals industry. From Pre-Engineering through design and construction Kaiser Engineers provides complete one-company service and ingenuity based on years of experience.

KAISER ENGINEERS

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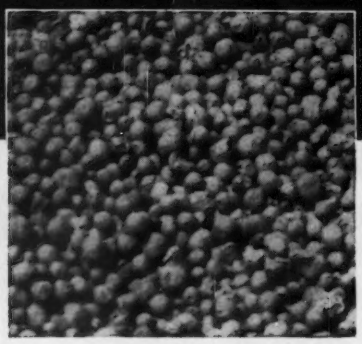


Typical Mesabi Range material: abrasive, heavy

Rubber-tired machines the only practical solution

From a distance it looks like any other stockpiled material. Then you come close and you see *this is something different*—something that combines many of the worst characteristics of sand, gravel, even rock. It's abrasive. Dead. Heavy. You've heard the name. It's *taconite!* Processed taconite! Round pellets, varying from a half-inch to three-fourths inch in diameter, blue-gray in color, 63% pure iron.

When rubber-tired machines can handle such material *successfully*—day in and day out—with rubber's obvious advantages of mobility and no track wear—that's real news for maintenance-minded firms that have almost *any sort* of stockpile or feeding problem.

This Minnesota taconite plant has *five rubber-tired Michigans.* These include a 2¼ yd Model 175A, a 2 yd 125A, and two 1¼ yd 75A Tractor Shovels . . . and the 262 hp Model 280 Tractor Dozer pictured. The Tractor Dozer exemplifies Michigan advantages . . .

Advantage No. 1—Tire Life

This 56,000 lb machine started work about a year ago. To date, its tires show virtually no wear. The machine does a variety of jobs. For example . . .

Advantage No. 2—Mobility

1. Levels the multi-million ton taconite pellet and stockpiles. Machine works on 2-to-1 and 3-to-1 slopes, has surprised men on the job with its ability to climb steep grades on loose footing.

2. Cleans around the 10-yard pellet-loading shovel. Major advantage in this operation is way Michigan's low-pressure tires don't crush the pellets . . . a real problem with crawlers.

3. Maintains haul roads.

4. Tows disabled trucks.

5. Cleans spillage around distant pellet plant. Unit gets to this assignment, 2 miles away, at 28 mph, travels under own power without waste of lowboy loading or unloading, does no damage to RR tracks or blacktop roads.

6. Cleans under hopper. Here, operator dozes normally until he accumulates load. Then he hydraulically pivots blade back, lifts material, turns and dumps outside of rail tracks.

Advantage No. 3—Dependability

Key to Michigan success, however, has been dependability! Entire power train of each machine—torque converter, power shift transmission, planetary axles—is designed and built by Clark, specifically engineered to give more usable power and traction than you've ever seen on rubber. Get the proof of a demonstration. Four Michigan Tractor Dozer models—162 to 600 hp—eight Michigan Tractor Shovels—16 cu ft to 6 cu yds—to choose from.

Michigan is a registered trademark of

CLARK EQUIPMENT COMPANY
Construction Machinery Division

CLARK® EQUIPMENT

2465 Pipestone Road
Benton Harbor 33, Michigan

In Canada:
Canadian Clark, Ltd.
St. Thomas, Ontario

Dredging up 57,481,000 yards of river bottom in 8 seasons— with the hose still in good shape—was the best service these Mississippi River dredge operators had ever gotten. And they got it from special 38-inch Sand Suction Hose recommended by the G.T.M.—Goodyear Technical Man. This long, trouble-free operation was a real time- and money-saver, too. For every replacement of the hose-link between the dredge ladder and the suction line takes a full crew's efforts for 3 days. More important, the dredge is out of action all that time. So it's easy to see why this dredge operator has stayed with the G.T.M.'s longer-lasting hose.

GOODYEAR
GOODYEAR INDUSTRIAL PRODUCTS GTM-Specified
Special 38" Sand Suction Hose
for Mississippi River dredging
A Tube of super-tough stock to withstand razor-sharp wet sand
B Reinforcements of heavy wrapped fabric plies plus high-strength spiraled wire
C Heavy gauge cover resistant to gouging and scuffing

Leave it to the G.T.M. to come up with the answer when recurring failures of any industrial rubber product are hampering a key operation.

He and the Goodyear Distributor make a specialty of doing just that—whether the need is for V-Belts, Conveyor Belting or any other industrial product. Just look under "Rubber Goods" or "Rubber Products" in the Yellow Pages. Or write Goodyear, Industrial Products Division, Akron 16, Ohio.

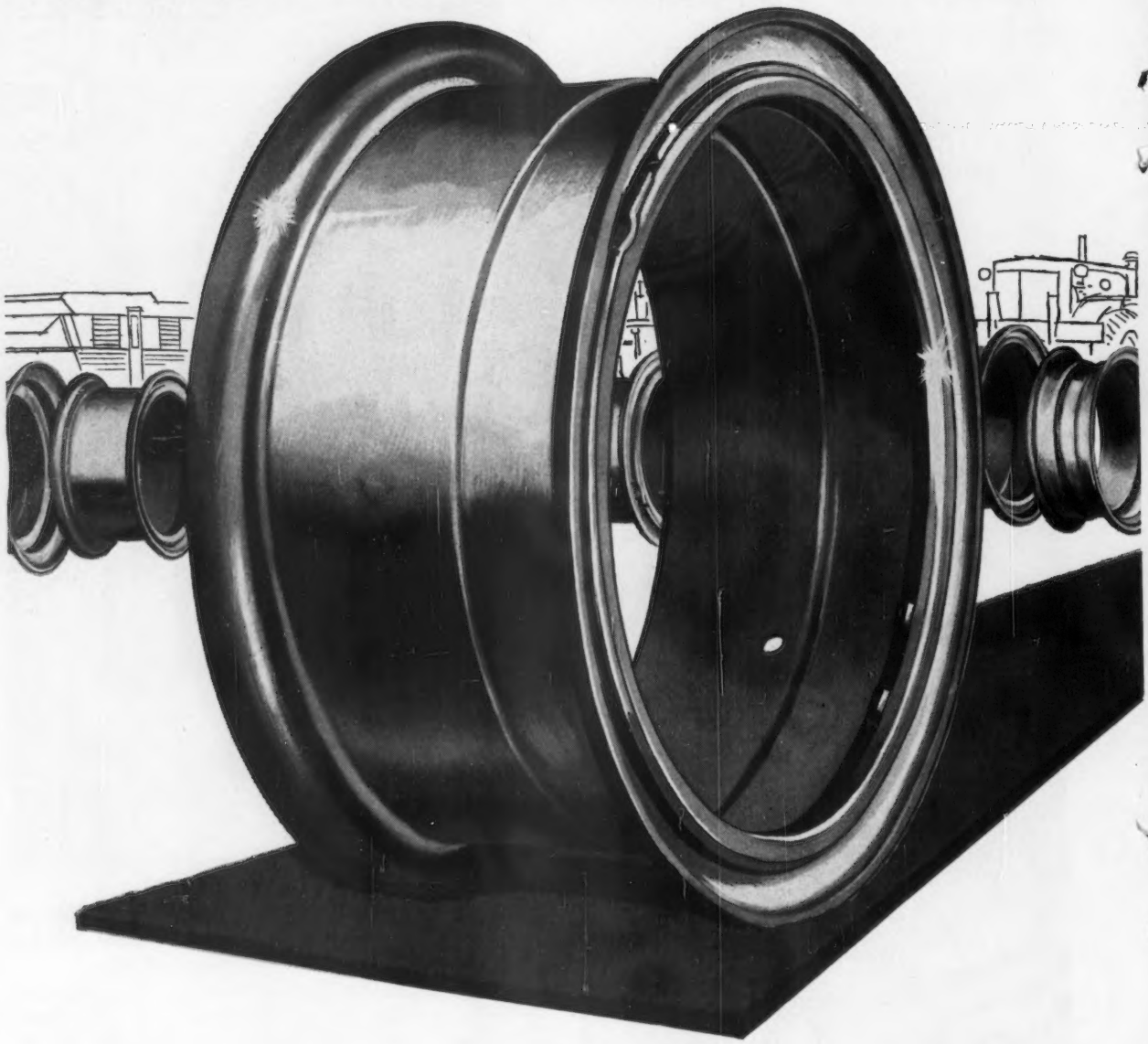
lots of good things come from

GOODYEAR

THE GREATEST NAME IN RUBBER

Presenting:

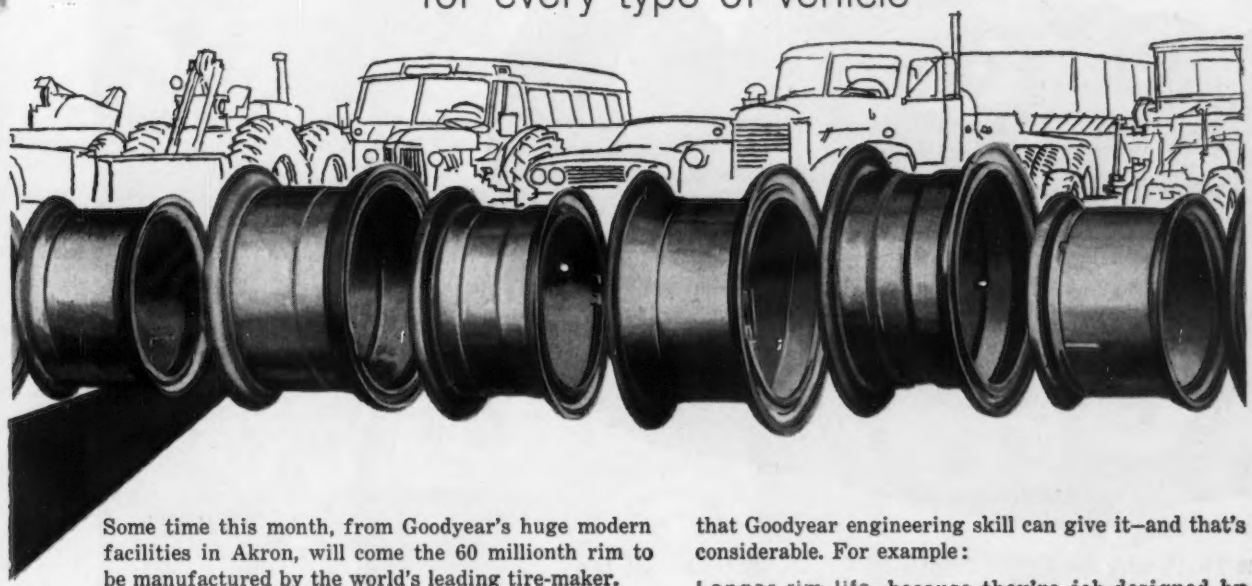
GOODYEAR'S 60



Lots of good things come from **GOOD**

MILLIONTH RIM

Latest, greatest in the world's most complete line of rims, designed to provide superior performance for every type of vehicle



Some time this month, from Goodyear's huge modern facilities in Akron, will come the 60 millionth rim to be manufactured by the world's leading tire-maker.

Most likely it will be a Job-Master.

And this is appropriate, for the Job-Master is the culmination of Goodyear's long experience in building rims for every type of vehicle.

The Job-Master is the first rim designed to fit properly all flat-bead tires—the first designed to seal out all foreign matter. In fact, Job-Master represents the biggest advance in "over-the-road" rim design in over 15 years.

But Rim No. 60,000,000 could just as well be anything from a lightweight rim for pick-up trucks to a mammoth 45" size for giant earthmovers.

Whatever size and type this historic rim happens to be, of this you can be sure: it will embody every advantage that Goodyear engineering skill can give it—and that's considerable. For example:

Longer rim life—because they're job-designed by experts.

Truer running performance—virtual elimination of "wobble" and "hop"—lateral and radial run-out.

Longer uninterrupted service—fewer road delays, more miles, lower cost-per-mile.

Bond-A-Coat Finish—a Goodyear exclusive, providing lasting protection against rust and corrosion.

Our industry leadership, experience and knowledge gained in building 60 million rims qualifies us to solve your rim problems. Write the Goodyear Rim Sales Engineer. Address: Goodyear, Metal Products Division, Akron 16, Ohio, or get in touch with your local Goodyear Rim Distributor.

GOODYEAR

More tons are carried on Goodyear Rims than on any other kind

Job-Master—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

Even in the remotest mining areas, ruggedness and freedom from service problems are ***musts*** *for crushers*

■ That's why the BIRDSBORO-BUCHANAN trademark is a familiar sight to natives in mining operations of many countries throughout the world. Management in these remote areas must be extremely careful in their selection of important equipment. Recently added to the long list of foreign installations of BIRDSBORO-BUCHANAN Deep Frame Jaw Crushers is the patented 42″ x 48″ unit now turning out 400 tons per hour in the Hierre de Arcari Iron Ore Mine in Peru. This heavy duty crusher was specifically designed to provide continuous trouble-free service.

Your Birdsboro representative can give you the profit-producing details for your own operation. *Sales Department, Engineering Department and Mfg. Plant:* Birdsboro, Pa.
District Office: Pittsburgh, Pa.

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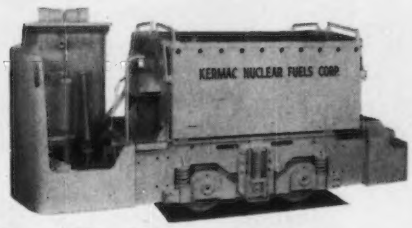
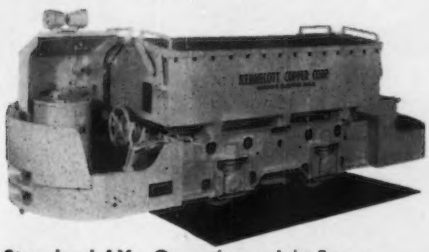
STEEL MILL MACHINERY • HYDRAULIC PRESSES • CRUSHING MACHINERY • SPECIAL MACHINERY • ROLLS • ELECTRIC STEEL CASTINGS: Carbon, Low Alloy and STAINLESS STEEL

Little Trammer—Operating weight 1.7 tons, tractive effort 500 lbs, speed 4 mph.

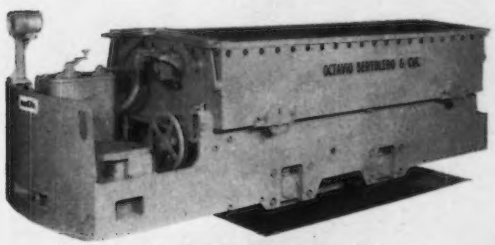
Titan BN—Operating weight 3 tons, tractive effort 800 lbs, speed 4 mph.



Titan ANX—Operating weight 4 tons, tractive effort 1600 lbs, speed 3.25 mph.



Standard AX—Operating weight 5 tons, tractive effort 1900 lbs, speed 4 mph.



Standard AX—Operating weight 6 tons, tractive effort 3600 lbs, speed 4 mph.

MANCHA storage battery locomotives

. . . A complete range of sizes for practical, low cost haulage service in metal and non-metallic mines.

Standard ABX—Operating weight 7 tons, tractive effort 2000 lbs, speed 4.25 mph.

Hercules BX—Operating weight 9 tons, tractive effort 4000 lbs, speed 6 mph.

Mancha specializes in fitting the locomotive to the job. Let us know your requirements.

MANCHA LOCOMOTIVE

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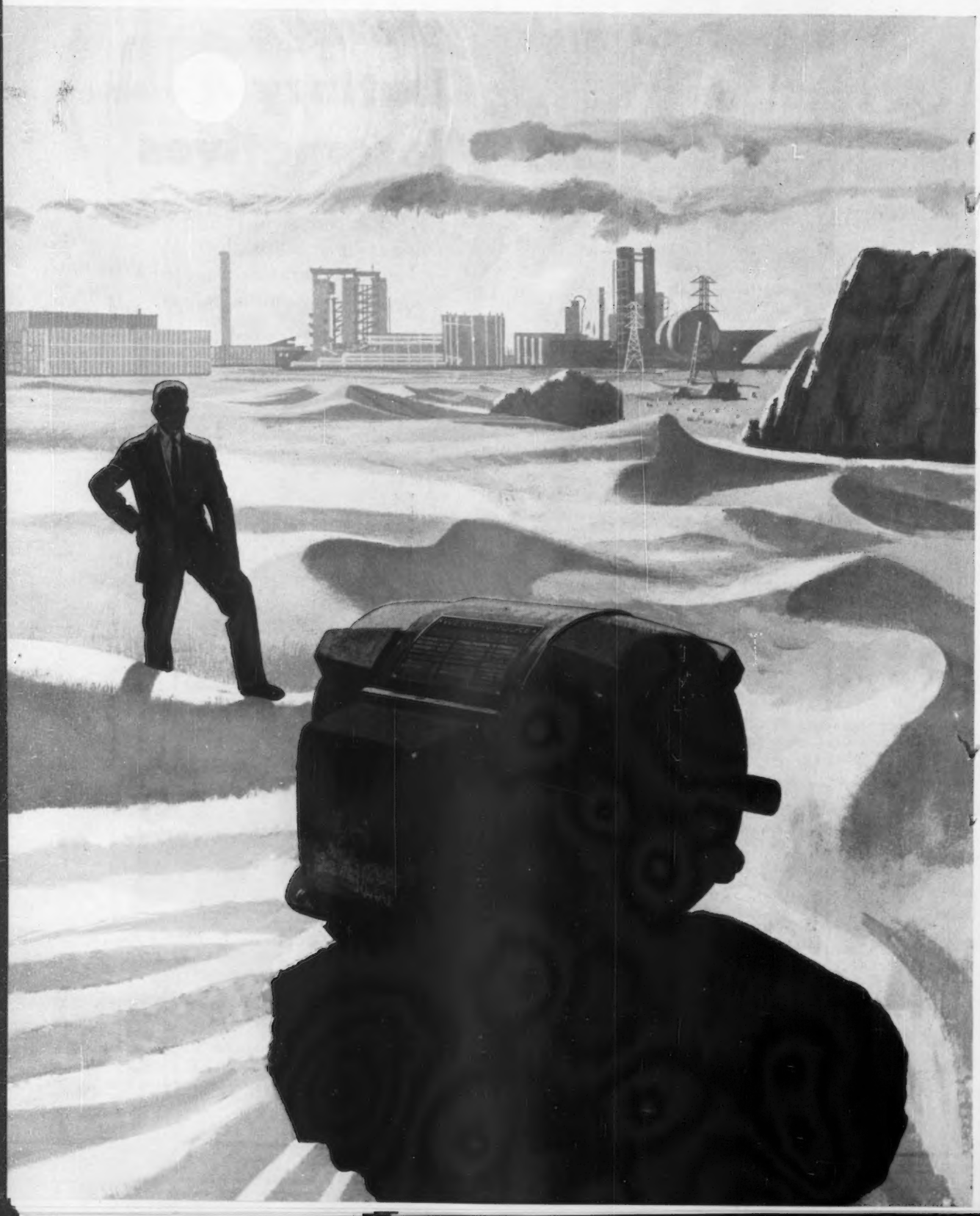
Cable Address: Mancha, Chicago
Mancha representatives are located in principal mining areas throughout the world.

New Guardistor

THE MAN & THE MOTORS



FROM WESTINGHOUSE

Guardistor motors let you match the full capability of the motor to the job— with complete safety—absolute confidence

Our Marketing Manager says:

- "You can match the motor to the load . . . use all the motor you are paying for.
- Provides positive protection based on winding temperature . . . *not* load current and/or power supply fluctuations.
- Eliminates time and expense of changing winter-summer heaters. No nuisance tripping, it's fail-safe . . ."

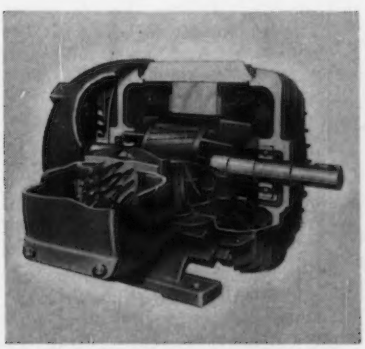
Our Engineering Manager says:

"With the breakthrough development of the Westinghouse Positive Temperature Coefficient thermistors, for the first time we can provide inherent protection against motor failure caused by excessive heat. The solid-state thermistors buried in the windings instantly sense excessive heat from any cause and simultaneously warn of trouble or automatically take the motor off the line. Thus, motor protection is placed where only true motor protection can be . . . in the windings."

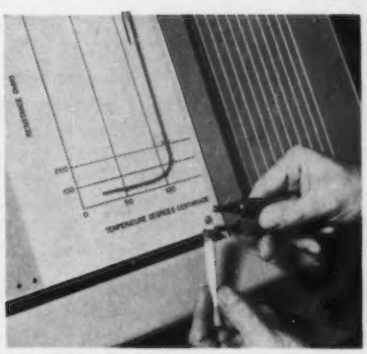
Call your Mr. Westinghouse for the application of a Guardistor* motor to your drive requirements . . . write for *Questions and Answers About . . . Guardistor* (B-7876). Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

*Trade-Mark

J-22160



Unlike remotely located sensing devices, PTC thermistors are buried in the windings of the Guardistor motor, instantly equating all temperature factors.



Ever alert PTC thermistors constantly totalize temperature, statically triggering an action *only* if critical temperature is reached.

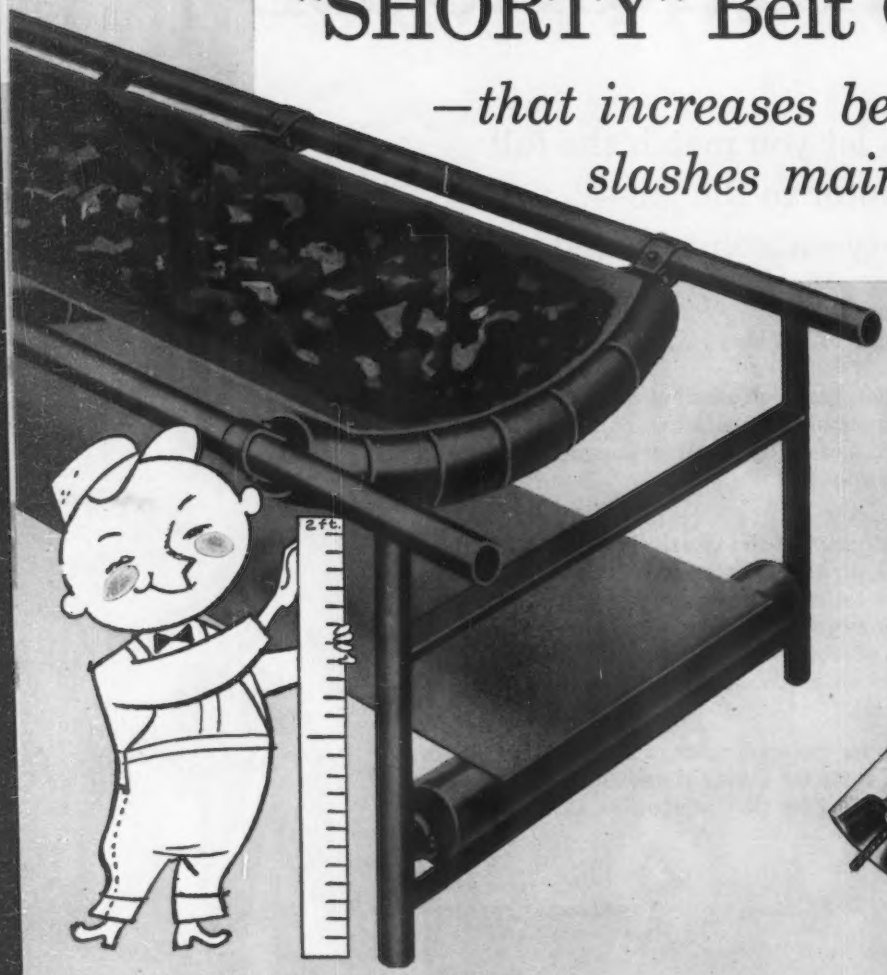
MOTOR & GEARING DEPARTMENT

YOU CAN BE SURE... IF IT'S

Westinghouse

See the NEW McNally Pittsburg "SHORTY" Belt Conveyor

—that increases belt life, slashes maintenance cost!



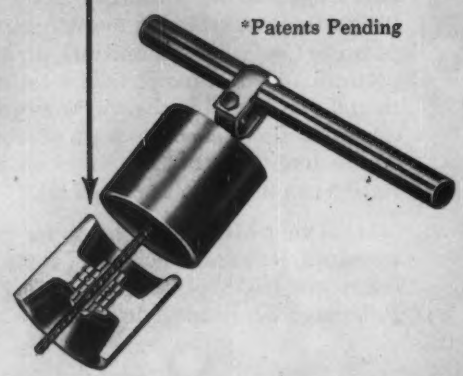
The "Shorty" unit is only 2 feet high!

The new "Shorty" underground conveyor featuring the new McNally Pittsburg Cradle Idler is ideally suited for use in limited working areas. Vertical supports are only 2 feet high. For extremely low clearance installations these conveyors can be made with 3″ diameter rollers (instead of the standard 5″), and the average over-all height can be as little as 17″ for a 36″ belt, using a 30° deep trough idler construction.

For "Do-it-yourself" construction, the H-frames and stringers (which may be either wire rope or pipe stringers) are shipped disassembled and may be assembled in the field to fit any conveyor length necessary. It is only necessary to cut the stringers to the desired length, attach the Cradle Idlers and H-frames, and your conveyors are ready for operation.

Exclusive NEW Cradle Idler*

*Patents Pending



The secret of the dramatically improved performance and lower maintenance cost of this new heavy duty conveyor is the *true catenary suspension* of the Cradle Idlers. Since the rollers *rotate* on the steel rope, dangerous "loping and harmonics" cannot develop. The 5" rubber rollers, assembled on precision ground ball bearings, are prelubricated, lifetime sealed.

- Increased belt life—because full belt support is maintained under all conditions
- No creasing or cutting of belt
- Minimum maintenance

McNally Pittsburg Mfg. Corp., Pittsburg, Kansas

☐ Please send information on the new McNally Pittsburg belt conveyor.

☐ Have Sales Engineer call for further consultation.

Name_____ Title_____

Company_____

City_____ State_____

EMJ

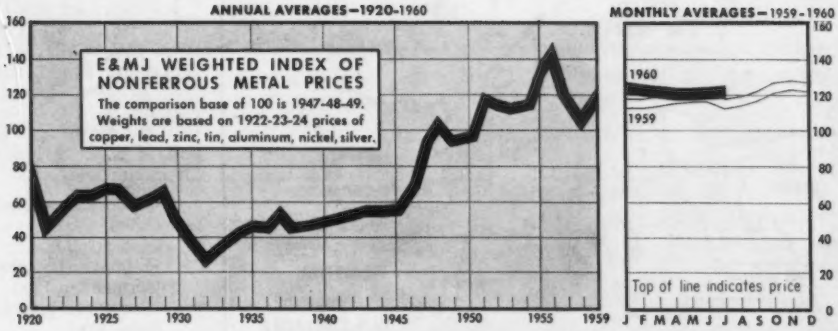
McNALLY PITTSBURG

MANUFACTURERS OF EQUIPMENT TO MAKE COAL A BETTER FUEL

McNally Pittsburg Manufacturing Corporation—Manufacturing Plants: Pittsburg, Kansas • Wellston, Ohio Engineering and Sales Offices: Pittsburgh • Chicago Rio de Janeiro • Pittsburg, Kansas • Wellston, Ohio

E&MJ OUTLOOK

PRICES


ANNUAL AVERAGES—1920-1960
MONTHLY AVERAGES—1959-1960
E&MJ WEIGHTED INDEX OF NONFERROUS METAL PRICES
The comparison base of 100 is 1947-48-49. Weights are based on 1922-23-24 prices of copper, lead, zinc, tin, aluminum, nickel, silver.
1960
1959
Top of line indicates price
J F M A M J J A S O N D

MARKETS

With the exception of tin, nonferrous metals prices remained steady for the fourth consecutive month. Because of a 2.2¢ increase in the average tin price, E&MJ's nonferrous metals index moved slightly from 125.9 for June to 126.1 for July.

U. S. gold stocks dropped $70-million during the week ended July 27. This decrease brought the U.S. gold stock to $19,164-million, the lowest level since May 1940. Cause of the decline was an unfavorable trade balance, and not the cashing in of dollars for gold by foreigners.

•

AT HOME

Capital spending is on the rise. Industry plans to invest $37.9-billion in plants and equipment in 1960, a 16% increase over 1959, according to the 13th Annual Survey of Business' Plans for New Plants & Equipment completed recently by the McGraw-Hill Department of Economics. Industry plans to spend $9,554,-600,000 for research and development in 1960, and $10,711,900,000 in 1963.

Iron ore imports to the U.S. have jumped from 9.2-million net tons in 1950 to 39.9-million tons in 1959. During 1959 Canada accounted for 15-million net tons, and Venezuela for 15.2-million net tons.

•

LABOR

Union leaders will demand that the new Congress legislate a 32- or 35-hour work week to spread work. Management is behind a bill which would bar unions from negotiating over jobs eliminated by automation or other factors. See p 21.

•

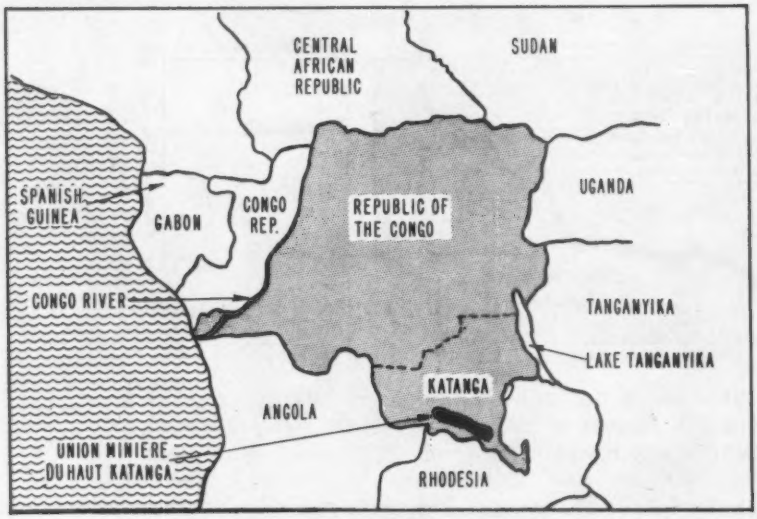
ABROAD

Chilean copper production, now potentially 480,000 metric tpy could be increased by 200,000 tpy if current negotiations between the Chilean government and producers are concluded. Bache & Co. estimates that Kennecott's contemplated $200-million expansion program could account for an increase of 100,-000 tpy.

Belgium's investments in the Congo are estimated to total about $3.5-billion. Annual investments required to sustain the Katanga area were about $140-million.

Representatives of Borax Argentina, S.A., are in the U.S. seeking equipment to increase processing capacity of the company's borax plant at Salta, Argentina. Extensive borax reserves, west of Salta, are believed to exceed those in California.

Political unrest in Africa, Cuba and several Latin American areas has shifted the interest of exploration engineers to more attractive areas in the U.S. and Canada. More than 50 of the world's largest mining companies are searching for ore deposits in British Columbia and the Yukon. Representatives from African, South American and Japanese firms are active in western Canada.



THE NEW CONGOLESE REPUBLIC (shaded area) was born at the end of June 1960 amid strife and rioting. Effective intervention by the United Nations has restored an uneasy calm in the young nation, which now must settle the "secession" of Katanga province, with the latter's rich mineral deposit (dark area).

Birth of a New Nation Places Katanga in World Spotlight

THE CLICHE of "burgeoning Africa," long a favorite phrase of the press, is to expire. Africa is no longer burgeoning—it has burgeoned. The vast continent, the traditional "sleeping giant," is demanding freedom, independence, local government and greater personal wealth with the zealot's disregard of whether the rest of the world thinks it is "ready" or not. As this issue of E&MJ went to press, the area centered in the new Republic of Congo was still the focus of political and mining industry attention.

Politically, the situation seemed to be slowly easing. From the violent and tragic riots which followed Congolese independence June 30, through the decision by the United Nations to dispatch troops to the area, and the gradual, but smooth, taking-over of police authority from the incumbent Belgian troops by UN forces, a demi-peace seemed to be restored. Thanks to the indispensable intervention of the UN, and the immediate reception before the world organization of the various arguments rising from the riots, Secretary Dag Hammarskjold was able to lead the Congo away from violence toward negotiation.

Mining is the economic center of the area, and the foundation upon which the new nation plans to build its future. And it is the mining areas, both in and near the Congo, which now hold the center of attention. In Katanga, site of the famed Union Miniére du Haut Katanga, provincial premier Moise Tshombe declared his sector an independent state and "seceded" from the new Congo nation. His passionate statement of secession and insistence of continued association with Belgium was resisted with equal intensity by Patrice Lumumba, new premier of the Congo. Katanga remained the greatest problem faced by the UN's Hammarskjold at month-end. His work was further complicated by the fact that both leaders are strongly opposed by some members of their own governments.

Nor was the effect of Congolese independence confined to that area; in Southern Rhodesia, African nationals rioted and looted shops and beer halls in the African townships and struck all industry for a period of three or four days. In Bulawayo and Salisbury there was unrest following the arrest of some leaders of the National Democratic party and the Central African party on charges of "incitement." Troops sent to the scene by the government confined the outbreaks to the African townships and order seemed to be restored at month-end.

In Belgium, courts took testimony of beatings and rape perpetrated by members of the Congolese army and police forces upon Belgian residents of the Congo. The Congolese army was characterized as "mutinous" by Lumumba and was being sought through the vast area by Belgian and UN troops. Congolese soldiers in the major cities surrendered their arms to UN soldiers immediately upon the arrival of Hammarskjold-appointed forces.

9% of the World's Copper

Katanga (see map) remains the core of the situation. Its mines account for some 9% of the world's production of copper and it is a rich source of cobalt, zinc, uranium, manganese, germanium, cadmium, tin, gold and silver. Production, as announced in the 1959 annual report of Union Miniére, was as follows: (in metric tons)

Copper	280,403
Cobalt	8,431
Zinc (conc)	117,778
Uranium (not given)	
Germanium (kg)	13,643
Cadmium (kg)	98,841
Gold (kg)	24
Silver (kg)	148,307

Union Miniére is preparing to open several new orebodies to compensate for the exhaustion of the famed Shinkolobwe and Lukuni. Production is either being maintained or increased at its Kolwezi, Kipushi, Ruwe and Shinkolobwe concentrators and at the Ruashi washing plant. Some iron ore and sulphuric acid is also produced. Union Miniére still has a $10-million cobalt contract with the U.S. General Services Administration. That ore goes to the U.S. stockpile.

It is an accepted fact that, while Katanga could probably get along without the new Congo nation, the Congo needs Katanga for survival. The new nation had debts, for public works, social programs, etc.; and those obligations have grown. Besides, the people of the Republic, because of speeches by some campaigning politicians and their own naive definition of "independence," believe that immediate personal wealth and income is synonymous with the achievement of "freedom."

Enter the Financier

The announcement by New York financier L. Edgar Detweiler that he has agreement from Mr. Lumumba for an ambitious 50-year, $2-billion private Congo mineral development scheme, touches on the difficulties posed by the political naiveté of the native Congolese. Some U.S. officials fear that the plan, despite the mineral potential of the Congo, may encourage the Congolese to too-great enthusiasm for future prosperity and incur eventual disappointment and resentment of the U.S.

Up to this point, Washington feels, significant diplomatic points have been scored by the U.S., both as a friend of the new nation and against any attempt by the Soviet Union to further capitalize on the unrest in Africa. By refusing unilateral action with Lumumba and working through the UN, Washington has effectively forestalled eager Russian countermoves.

But the U.S. knows that there are many stumbling blocks on the way to peaceful political and industrial development of the Congo. That is why it was quick to offer immediate relief aid and technical assistance to Mr. Lumumba during his visit in Washington, but could not give too-specific promises of long-

range support. Much depends on the success of the Lumumba government, the eventual investment climate for private U.S. firms, and the settlement of the Katanga question. In the latter area, no other nation has recognized the Tshombe secession, not even Belgium, and both premier Kwame Nkrumah of Ghana and Sekou Touré of Guinea have attacked it. There is hope that a solution, with Katanga associated with the Congo in a loose confederation, may be effected. Here again, the United Nations holds the key.

Can-Fer Claims Large Magnetite Discovery

Development drilling of what is estimated as a 130-million ton orebody of plus 66% Fe is underway in Western Ontario by Can-Fer Mines Ltd. Early samples of the ore indicated 67 to 69% magnetite with 3.7 silica.

The greater number of claims held by Can-Fer are in the Kowkash area, which the company notes, is about 185 mi from the Lake Superior ore docks and close to the Trans-Canada Gas pipeline.

New X-ray Device Gives Rapid Flotation Control

THE QUANTROL X-ray device of Anaconda Co.'s Anaconda smelter gives an almost instantaneous copper assay of mill products, which allows mill operators to make quick adjustments and corrections when necessary.

Essentially, the device X-rays slurry samples received through pipelines from various parts of the mill, and gives a quick copper assay. It assays 13 different samples of five different family groups, reporting an assay on each sample every 15-30 min. A density gage corrects for fluctuations in the solids content, and a computer instrument combines this information with the X-ray readout to deliver the correct assay.

Remote indicators inform operators of the flotation circuit in the mill of the assay of their feed, concentrate and tailings. Since they get these reports at least every 30 min, the operators can almost perfectly control the quality of the product, quickly taking any corrective action that the assay reports show necessary.

1961 Mining Research Panel Planned at Rolla

AN INTERNATIONAL SYMPOSIUM on Mining Research will be held Feb. 22-25, 1961, at Rolla, Mo.

The symposium, which will be sponsored by the U.S. Bureau of Mines and the Missouri School of Mines & Metallurgy, will deal with explosives and blasting, rock mechanics and the application of basic science to mining.

(*News continues on p 124*)

As We Went to Press . . .

"If it (the pilot plant process) proves out in the new facility, future aluminum plants would be able to skip the alumina stage of the conventional process as it exists today."

With those words, a spokesman for Aluminium Ltd. defined the hopes which his firm has tied to a $4-million pilot plant now under construction at Arvida, Que.

A formal announcement by Nathanael V. Davis, president of Aluminium, stated that the process "employs, as its principal raw material, bauxite of roughly similar grades to that required by the conventional process for the production of commercial aluminum.

"The new process does not appreciably reduce the large power requirement . . . (but) it does give promise of substantial savings in other elements of production cost . . . "

The experimental unit will have a 6,000 to 8,000 tpy capacity and will be operated primarily to confirm ". . . conclusions already reached." Operation is due in two years.

A majority of controlling interest in Cia. Minera de Penoles has been sold by American Metals Climax to a group of Mexican banks, investment houses and individuals. The lead-zinc property (see E&MJ, October 1958, p 86) has modernized haulage methods and other mining techniques in its competition for a share of the base metal market.

The new group is purchasing 51% of Amax's holdings, according to Mexican reports, and will obtain subsequent financing.

Sr. Eduardo Bustamente, minister of national patrimony, in a speech made several months ago, referred to a "new law" being considered by the government of President Adolfo Lopez Mateos to encourage the "Mexicanization" of mining and to encourage Mexican ownership of the raw materials industries of the country.

Susquehanna-Western Inc. will build the 26th uranium plant in the U.S. and the first in Texas under an agreement signed in late July with AEC.

The processing facility, to be built near Falls City, Tex., will have a capacity of 200 tpd and will cost approximately $2-million, according to Allen D. Gray, president of the Susquehanna Corp. subsidiary.

A second break-through in reduction of beryllium ores from the Mt. Topaz area of Utah was made late last month by Beryllium Resources Inc. and Brush Beryllium Co. Vitro Minerals previously had announced that the Topaz ores were amenable to acid reduction (July 1960, p 27).

Bruce Odlum of Resources and Bengt Kjellgren of Brush made the later announcement and it was learned that the process involves "several steps" with a resulting beryllium hydroxide which can then be processed into oxides and metals and alloys. Dr. Norman C. Williams, vice president and chief geologist of Resources, confirmed that his firm now holds some 2,700 acres in claims in the Topaz-Spor Mt. section.

A high-grade iron ore deposit is reported in the south central sierras of Peru at an elevation of 14,000 ft, about 125 miles from the coast "as the condor flies." Its discoverers, Gustavo Rios Pita and Alberto Pool Ramierez, of Lima, consider the deposit similar in size and grade to Chile's El Laco deposit.

WASHINGTON IMPACT

Highlights

ONE MORE TIME—Domestic Mining industry hopes for new Government economic policy assistance got several unexpected shots in the arm last month. It still is anyone's guess whether the revived hopes will prove premature or false.

Here is what spurred a rebirth of mining industry optimism in Washington:

The U.S. Court of Customs & Patent Appeals challenged the President's legal authority to tone down Tariff Commission recommendations for higher duty rates on foreign imports that are found to be injuring domestic competition. The case involved English bicycles, but it may also be applied to White House modifications of other recent Tariff Commission recommendations—most importantly on lead and zinc, and also on stainless steel flatware and spring clothespins. (See story this page.)

Sen. Robert Kerr (D-Okla.) reported substantial progress in lining up votes on Capitol Hill for his bill to roughly double present import duties on lead and zinc. According to Congressional observers, Kerr has the ear of Democratic Vice Presidential nominee Lyndon Johnson (D-Tex.) and Republican Vice-President Richard Nixon, both of whom reportedly would prefer to see a tariff hike on lead and zinc passed in August, rather than tackle the politically double-edged issue under a new administration of either party next year. Moreover, say Kerr confidants, Mexican importers—represented by former Interior Secretary Oscar Chapman, a Johnson supporter—are privately saying they can accept the Kerr duty increases. The damper on this possibility is the threat of an Eisenhower veto of Kerr's bill.

Whatever happens to lead-zinc tariff proposals, mining policy experts in Congress are predicting flatly that Kerr's small lead-zinc mine price subsidy bill will pass and be signed into law.

Longer-range, a real Congressional battle over Washington's import policies next year is looming. Both political party platform trade planks acknowledge stepped-up domestic industry pressures for trade protection or "adjustment." The Democratic plank calls for outright Federal subsidies to U.S. industries who can prove they have been injured by foreign competition. The Republican platform adheres to the Reciprocal Trade Agreements Act, but puts new emphasis on administration of escape clause, peril point, and other clauses aimed at giving domestic producers "selective" relief.

The last point holds out what may prove to be the most solid hope for domestic seekers of increased trade protection. Ironically, both supporters and critics of Washington's 30-year trend toward lower import barriers recently have been calling for a complete Congressional revamping of existing Tariff Act and Reciprocal Trade Agreements laws on the books. This is the pitch that the Trade Relations Council (formerly the American Tariff League), headed by ex-Commerce Department official Horace B. McCoy pressed on Democratic and Republican platform committees at Los Angeles and Chicago last month. It also is supported by the free trade lobby, Committee for a National Trade Policy, led by Charles P. Taft, brother of the late Senator.

The liberal and restrictive trade groups part violently, of course, on the question of what direction a new trade law should take. But they agree that the Cordell Hull multilateral trade agreement approach may be outmoded in light of changing international economic conditions.

Trade experts on Capitol Hill go along with the prediction that Congress next year may be up to its ears in a great debate on new trade policy legislation. Some dozen or more Senators and Congressmen already have bills or resolutions in the legislative hopper calling for a new law.

Proposals will vary over the lot. One will center around the idea of subsidizing domestic industries hurt by foreign import competition. Another will stress regional market trade negotiations instead of worldwide trade talks such as are coming up this fall in Geneva, Switzerland. (See story this page.) Still another will urge tariff rates tied to foreign and domestic wage-cost differentials.

The present Reciprocal Trade Agreement law does not expire until June 1962. But long before then, Congress will be embroiled in its bitterest trade and tariff policy debate in years.

Bicycle Verdict Bears On Lead-Zinc Quotas

A customs court decision on a bicycle tariff case (see highlights) last month has threatened to disqualify current import quotas on lead and zinc. Longer range, it also seriously challenges the President's legal authority to modify or make less restrictive tariff commission recommendations for higher tariff duties based on the so-called escape clause provision of the law.

The bicycle case was fought out under the 1955 Reciprocal Trade Agreements Act. The President accepted a commission finding of import injury to domestic manufacturers, and adopted all but one of the agency's recommendations for higher tariffs. In one category of bicycles, however, the President ruled the Commission had urged too high a duty hike, and ordered a boost in rates only half as much as the Commission had urged.

Domestic makers won a challenge in a lower Customs Court on grounds that the White House has no authority under the law to rewrite Commission suggestions. This was the decision the U.S. Customs Court of Appeals upheld in Washington last month.

The Administration may or may not appeal the decision to the Supreme Court. Traditionally, the White House has followed Commission escape clause recommendations, in the minority of cases which he has not rejected altogether.

But in the case of lead and zinc, and also on stainless steel flatware and spring clothespins, the President has ordered milder protection than that urged by the Commission.

The Government has argued that its authority rests with the 1930 Tariff Act, not with the newer Reciprocal Trade laws. Further, the language of the 1958 Trade Agreement Act extension seems to indicate that Congress recognizes the President's right to rewrite Commission decisions. The language of that act provides that Congress may, by a two-thirds vote, override the President when he rejects Commission recommendations "in whole or in part."

Yet there was, at E&MJ's presstime, still a question in the minds of Government lawyers as to whether to appeal the Customs Court decision to the Supreme Court. The Customs Court ruling binds only the bicycle case.

However the issue is settled, it raises significant speculation over how the Commission and the White House will handle the question in the future. If an "all-or-nothing" stipulation is put on Commission escape clause recommendations, it could make them tougher—on grounds that having established injury to a domestic industry, the Commission might in effect be able to force the White House to take whatever steps it recommends. On the other hand, fear of a total rejection of its findings by the White House could lead to less restrictive Commission recommendations.

Mining State Solons Protest GATT Listing

Tariff and trade negotiation hearings are now under way in Washington. These are the public forums at which domestic producers, traders and consumers traditionally register their views on what items should and should not be the subject of international tariff bargaining sessions under the General Agreement on Tariffs and Trade (GATT). Domestic producers also get a chance to plead for so-called peril points below which U.S. GATT negotiators may not cut tariffs for fear of injuring domestic competition.

The Tariff Commission, which sets the secret peril points, and the inter-agency Committee for Reciprocity Information (CRI), which rules on what items should be bargained, get around to metals and manufactures the end of this month. Hearings are set to run from August 25-September 9.

The hearings, routinely, are on the initial list of items which the Administration has offered up for U.S. tariff cuts, as well as on the list of U.S. exports for which negotiators will try to win lower foreign import concessions. This round of hearings, the sixth and most hotly contested since the first in 1947, is in preparation for GATT sessions in Geneva, Switzerland, this fall. U.S. tariff cuts will not be offered until next January. After the hearings, the offer list is usually pared down considerably before a final list is taken to GATT.

This year, the Government is offering tariff cuts on a long list of iron and steel products and nonferrous metals (E&MJ, July 1960, p 28), and asking foreign concessions on practically everything the U.S. exports.

Lead and zinc, per se, were not on the initial offer list. However, an ardent protest has been registered with the White House by Senate Interior Committee chairman James Murray (D-Mont.) and ranking minority member Henry Dworshak (R-Idaho) on this point:

The offer lists, claim the Senators, contain 43 tariff schedule paragraphs of finished products or intermediate products which contain some lead and zinc, or in which the metals are used in processing them. The categories include paints and pigments, glassware and ceramic tile, chemical compounds, flashlights, vehicular parts, linoleum, rayon products, paper, asbestos shingles, cartridge shells and rubber tires.

The White House has assured the mining-state Senators that their views will be considered by the cabinet-level trade policy committee which reviews the lists after the public hearings.

But domestic lead-zinc producers are unhappy because they are precluded from testifying on the finished and semi-finished articles containing the metals because these are not technically in direct competition with the raw materials turned out by domestic mines and nonferrous mills and smelters.

Labor This Month

AUTOMATION GOES TO CONGRESS: Unions and employers are carrying their contest over the after-effects of automation to Capitol Hill. Starting in January, the 87th Congress will face important legislative proposals to ease difficulties that arise for both with industrial mechanization. It will be an extension of the bargaining table battle over automation that continues to pick up steam.

Here's what is coming:

Union leaders will demand that the new Congress legislate a shorter work week in a spread-the-work drive. AFL-CIO chief George Meany wants a 35-hour week—five days at seven hours each. United Steelworkers president David J. McDonald asks a 32-hour week at four eight-hour days. Other union officials will come forth with shorter work week proposals, all aimed at trimming the levels of unemployment caused by automation.

Management will push a legislative demand that would bar unions from negotiating over the loss of jobs. Employer groups are behind a bill by Senate Republican leader Everett Dirksen that would permit employers to abandon jobs without accounting to unions in doing so. Currently, a union can insist on negotiating over an employers' effort to eliminate jobs, as a consequence of automation or other factors. But the Dirksen Bill would specify such a step as a management prerogative—not subject to union veto or change through collective bargaining.

CURBING THE IMPORT THREAT: Increasing anxieties over imports, and the threat of U.S. jobs, has union officials working overtime for a solution. Traditionally free-traders, some labor officials are now calling for high tariffs. One troubled union, the International Ladies Garment Workers, has discovered a new answer. When an employer—Kenrose Manufacturing Co.—opened an overseas plant in Ireland, the ILGWU struck the company operations in the U.S. The union won its demand, not the elimination of the Ireland plant, but a guarantee that Kenrose employees in the U.S. would not lose out to foreign competition. The company, after a four-week walkout by the union, agreed that the workload in the four Kenrose plants in Virginia would not be lowered despite its overseas output.

NO EXTRAS FROM THE EXTRA SESSION: Despite the renewed push by the AFL-CIO, Congress is unlikely to approve the federation's minimum wage and Taft-Hartley demands this month. Before recessing for the Presidential conventions, the legislators virtually killed AFL-CIO hopes for a $1.25 minimum wage and coverage of retail and service employees. The House offered a much modified bill hiking the Federal wage floor to $1.15 and bringing under it employees of large retail chains. At the same time, the House sat tight on a construction union proposal to ease T-H curbs on construction project picketing.

ORGANIZING—PHILADELPHIA STYLE: AFL-CIO industrial unions are attempting an organizing sweep throughout the big industrial areas surrounding this Eastern city. Nearly a dozen unions—led by the giant auto and steel unions, the machinists and electrical workers—are combing non-union plants in such industries as metal working, electronics, tool and die, steel fabricating and a variety of others. Targets range from the multi-thousand worker shops down to plants of less than 100.

This is a test-run drive to spur new organizing efforts across the country. If it works in Philadelphia, the system will be tried out in other major cities. Here's the way the system operates:

To avoid the usual jurisdictional squabbles, unions have divided up the territory rather than contesting each other for particular plants.

To keep down the high cost of organizing, unions are sharing staff organizers, trading organizing techniques, even sharing headquarters.

To keep the drive going full steam, top AFL-CIO industrial strategists direct it from central headquarters—plan daily organizing thrusts to try to build momentum over a proposed two-year campaign.

MARKETS

U.S. Copper Sales Slow; Good Outside; Lead Easy; Aluminum Billet Price Off

PRICES OF NONFERROUS METALS IN JULY were almost unchanged from June according to the E&MJ index of prices. The July figure was 126.1% of the 1947-49 average; June was 125.9%. The only change was an increase in tin to 103.538¢ a lb from 101.347¢ in June.

Copper prices in the U.S. moved little during July. Producers and custom smelters held to the 33¢ delivered price. Merchants moved their prices around much less than usual. For most of the month they were willing to sell electro for delivery within a few weeks at about 32¢ or 32¼¢, delivered nearby points.

Producers and custom smelters moved little copper in July. This was expected since July is the vacation month for many mills. But this was not the only reason—the mills had not been selling their products.

Fabricators had done a little better in June than in May. Shipments in June were 112,223 short tons, about 4,500 more than in May. But some factors indicated July was likely to be lower than June and maybe under May. June sales of fabricated products were up about 13,000 tons from the 113,926 in May. Unfilled orders were up even more—June was 132,070 and May was 117,150 short tons.

Fabricators' stocks of copper also dropped in June. Total stocks were down about 5,500 tons to 451,982.

Copper prices outside the U.S. moved about in July, but no more than usual. London prompt bid reached a low of £249½ (31¼¢) on the 22nd. The high was £260 on the 12th. The movement in London was largely determined by the news from the Congo.

In the middle of the month, the Europeans were in a rush to get out. Most had already sent their families from the Congo. Katanga, the copper producing area, had its share of the Congo trouble. Copper production either ceased or was cut sharply. Later there were reports that some of those who had gone to nearby areas were returning. Apparently copper production was resumed late in the month. Many feel that copper is so valuable to the Congo that somehow, it will be produced and sold. But others point to the uncertainty of life there and suggest that it will be difficult to keep technical and management personnel. Africans have not been trained to do their jobs.

Copper pricing outside the U.S. seemed to reflect the Congo news directly. In the week ending July 13 the tonnage priced was exceptionally high. Pricings reported to E&MJ for purposes of calculating weighted average prices were almost double the preceding week. They were again very high on the week ending on the 27th.

In Chile, possible trouble appeared between the workers and Anaconda. The union made a great many demands on the company. The current contract ends Sept. 30. The Chilean Copper Conciliation Board ruled that many of these demands were legal, including a wage increase. The company had rejected the demands.

Phelps Dodge Copper Products Corp. on July 1 consolidated the pricing discounts on copper and brass tube and pipe. In effect, it reduced the prices for large orders. The actual price spread between shipments of under 2,000 lb or ft and those over this figure is now 13.9%. For distributors that order a single shipment of 20,000 lb or over there is an additional 5% off. The company has written into a new price schedule the former 5% discounts for lots of 2,000 lb or over and added another 3% off. For orders of less than 2,000 lb there is an extra of 5%. Other fabricators are meeting the new prices.

Zinc sales in the U.S. in July were little different from June. July is often a poor month owing to vacations.

St. Joseph Lead Co. reduced the premium on Special High Grade zinc ¼¢ a lb to 1½¢ over the Prime Western price. It cut the premium on the High Grade by 0.15¢ to 1.35¢. The announcement was made July 11 and was effective July 1. Other sellers followed.

This move was not a surprise. When zinc alloy prices were cut in mid-May many factors said the premium on Special High would come down. Independent alloy makers said the cut in alloy prices put the "squeeze" on them. They say they need at least a 1¾¢ spread between the price of the Special High Grade metal and alloy No. 3. No. 3 is now 16.25¢ and SHG is 14.5¢ delivered. From April 1 to July 1 the spread was only 1.5¢. A number of firms had bought zinc at the lower prices earlier in the year and were able to stay out of the market until recently. A little SHG was bought from importers at under the U.S. price. Perhaps a minor factor in the premium drop was the sale of surplus metal by some users. This resale zinc appeared mainly in the mid-West. But it was mainly pressure from the independent alloy makers that led to the premium cut.

Strength in zinc late in the year is foreseen by some sellers. Buying for 1961 autos will probably start in August and may reach a peak in October. If buying of the galvanizing grade picks up then some see a tight zinc market. The fact that zinc has held up with a very slow steel and auto rate suggests potential strength.

Lead sales were easy in July and down from June. This followed partly from vacations among users. But soft conditions among various hard lines were also to blame.

Price quotations of the London Metal Exchange were steady all month. Prompt bid was about 8⅞¢. Consolidated Mining & Smelting reduced its Canadian price ½¢ a lb to 10½¢ at Montreal.

Aluminum demand is easy. This was further confirmed when Kaiser Aluminum & Chemical announced it would close one potline at its Mead, Wash., reduction plant July 23. Five of the plant's eight lines will continue to operate. Company officials said the intent is to reduce inventories. Primary stocks of metal have jumped up considerably in recent months.

Alcoa announced that August 1 prices of most aluminum mill products and of many alloy ingots would be raised. It attributed the increase to the 11½¢ per hour automatic wage and fringe benefit increase. Primary metal prices are not being raised, according to the company's vice president, L. P. Favorite. Labor costs are insignificant in primary aluminum production.

Most prices were raised ½¢ or ¾¢ a lb. Some mill product prices were raised more. At least one was dropped. Billet was raised 0.3¢ to 28.3¢. But a recent "discount" of 1¢ leaves this at 27.3¢.

Weak aluminum markets are upsetting the price situation for primary metal. Last week Aluminum Ltd. Sales, the sales subsidiary in the U.S. for Aluminum Ltd. of Canada, started offering what in effect is a 1¢ per lb discount on aluminum billets. It is an attempt to offset the high discounts offered customers by producers in the U.S. through paying the customers scrap prices well over the open market.

Producers pay 2¢ or 3¢ over the open market price. Ordinarily a fabricator will produce about 25 lb of scrap for every 100 lb of metal he uses. But some producers were willing to give the fabricator this price advantage for more than the usual 1 to 4 ratio of scrap return for new metal bought. This became too expensive and Aluminum now gives the buyer the option of a 1¢ discount for billet or the 1 to 4 ratio return of scrap at the going producer scrap buying price.

Aluminum Ltd. is building an experimental plant that will refine aluminum directly from bauxite. The major saving will be in investment cost. Companies usually estimate the investment cost at about $1,200 to $1,500 per ton of metal. At a 4% interest rate this is $60 a ton or 3¢ a lb. The new process may cut this to 1½¢.

Average Prices July (E&MJ Quotations)

Cents per lb unless otherwise indicated:

Copper:	
Electro, domestic refinery	32.600
Electrolytic, exports refinery	31.010
Electrolytic, c.i.f. Cont'l ports	31.955
Lead:	
Common, New York	12.000
Common, St. Louis	11.800
Silver:	
Silver, New York, per oz	91.375
Silver, London, pence per oz	79.250d
Zinc:	
Prime, Western, East St. Louis	13.000
Prime, Western, delivered (g)	13.500
Tin:	
New York Straits	103.538
Gold, per oz, U.S. price	$35.000
Sterling, Exchange	280.842
Quicksilver, per flask	$210.300
Antimony, (E&MJ) (d)	32.590
Antimony, bulk, Laredo	29.000
Antimony, in cases, Laredo	29.500
Antimony for. 99%	22.875(h)
Palladium, troy oz	$24.000
Platinum, refined, per oz	82.000
Cadmium (a)	140.000
Cadmium (b)	150.000
Al, 99½% dom., ingot	28.100
export, pig	23.250
Magnesium, ingot	35.250
Nickel, (f)	74.000
Bismuth	$2.250
Cobalt	$1.500

Domestic quotations, unless otherwise stated are in cents per lb. Sterling exchange checks, in cents. Quicksilver per flask of 76 lb.
(a) Per lb delivered, ton lots.
(b) Per lb delivered, small lots.
(d) Domestic 5 tons or more but less than carload lots, packed in case f.o.b. New York.
(f) Contract price, f.o.b. Port Colborne U.S. duty included.
(g) Delivered where freight exceeds 0.5c.
(h) 2c duty extra.

Free Gold Market

International gold trading volume increased 6% during June in rather brisk dealings. Bar prices lost fractionally while coins suddenly in demand gained between 1½ and 3% in most free centers. London was once more the most active market. Gold futures in very limited demand listed premiums of 4½% p.a. in Switzerland and 5½% p.a. in London, transactions averaging less than $250,000 daily. U.S. gold loss continued reducing the stock to a new low of $19.164-billion. Pick's World Currency Report quotes on "free gold" per fine oz as follows:

	Coins		Bars (12.5 kg)	
	June 30	July 30	June 30	July 30
New York transit	.....	.....	$35.08⅛	$35.08⅛
Manila	$39.85	$40.00	35.75	35.80
Hong Kong	48.15	48.40	38.70	38.90
Bombay	52.75	52.50	52.50	52.00
Beirut	39.50	39.25	35.26	35.25
Paris	38.80	39.75	35.35	36.10
Buenos Aires	38.90	39.10	35.55	37.80

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

Custom Smelter Copper

Based on flat price and E&MJ average price sales in U.S. for month of July reported by American Smelting & Refining Co. electrolytic copper in standard shapes, adjusted to nearest ⅛c; ¼c deducted for selling common.

Delivered consumer's plant	32.750 lb
F. o. b. refinery	32.350 lb

Major Metals

U.S. DAILY AND AVERAGE PRICES

Cents per lb unless otherwise indicated:

July 1960	Electrolytic Copper (a) Domestic	(b) Export	Europe c.i.f. (c)	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum Primary 99% U.S. Dest.	Straits Pig Tin New York
1	32.600	30.825	31.770	12.000	11.800	13.500	13.000	26.000	102.625
4	Holiday	30.950	31.895			Holiday			
5	32.600	30.875	31.820	12.000	11.800	13.500	13.000	26.000	102.375
6	32.600	30.975	31.920	12.000	11.800	13.500	13.000	26.000	102.625
7	32.600	30.825	31.770	12.000	11.800	13.500	13.000	26.000	102.875
8	32.600	30.850	31.795	12.000	11.800	13.500	13.000	26.000	102.500
11	32.600	30.975	31.920	12.000	11.800	13.500	13.000	26.000	102.500
12	32.600	31.725	32.670	12.000	11.800	13.500	13.000	26.000	102.500
13	32.600	31.675	32.620	12.000	11.800	13.500	13.000	26.000	102.750
14	32.600	31.600	32.545	12.000	11.800	13.500	13.000	26.000	102.875
15	32.600	31.025	31.970	12.000	11.800	13.500	13.000	26.000	103.000
18	32.600	30.900	31.845	12.000	11.800	13.500	13.000	26.000	103.375
19	32.600	31.000	31.945	12.000	11.800	13.500	13.000	26.000	103.625
20	32.600	31.300	32.245	12.000	11.800	13.500	13.000	26.000	104.250
21	32.600	31.425	32.370	12.000	11.800	13.500	13.000	26.000	104.750
22	32.600	30.875	31.820	12.000	11.800	13.500	13.000	26.000	104.750
25	32.600	30.550	31.495	12.000	11.800	13.500	13.000	26.000	104.625
26	32.600	30.550	31.495	12.000	11.800	13.500	13.000	26.000	104.750
27	32.600	30.875	31.820	12.000	11.800	13.500	13.000	26.000	104.750
28	32.600	30.625	31.570	12.000	11.800	13.500	13.000	26.000	104.625
29	32.600	30.800	31.745	12.000	11.800	13.500	13.000	26.000	104.625
AVERAGES FOR MONTH									
July	32.600	31.010	31.955	12.000	11.800	13.500	13.000	26.000	103.538
AVERAGES FOR WEEK									
July									
6	32.600	30.876	31.810	12.000	11.800	13.500	13.000	26.000	102.438
13	32.600	31.210	32.155	12.000	11.800	13.500	13.000	26.000	102.625
20	32.600	31.165	32.110	12.000	11.800	13.500	13.000	26.000	103.425
27	32.600	30.855	31.800	12.000	11.800	13.500	13.000	26.000	104.725
CALENDAR WEEK AVERAGES									
July									
1	32.600	30.925	31.870	12.000	11.800	13.500	13.000	26.000	102.000
8	32.600	30.895	31.840	12.000	11.800	13.500	13.000	26.000	102.594
15	32.600	31.400	32.345	12.000	11.800	13.500	13.000	26.000	102.725
22	32.600	31.100	32.045	12.000	11.800	13.500	13.000	26.000	104.150
29	32.600	30.680	31.625	12.000	11.800	13.500	13.000	26.000	104.675

THE above quotations for major nonferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered U. S. basis add 0.400c per pound, the average differential for delivery charges.

(b) Export copper daily quotations are weighted averages based on sales outside the U.S. reported to E&MJ. Ocean freight and 0.125c lighterage and handling are deducted to arrive at the f.o.b. Atlantic seaboard refinery quotation. On f.a.s. U.S. sales lighterage of 0.125c is deduced.

(c) The c.i.f. Continental ports quotation is arrived at by adding to the f.o.b. export quotation lighterage, and the standard conference freight and insurance, Atlantic ports to main Continental ports. Currently this is 0.125c and 0.82c.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West and West effective Apr. 1, 1960, commanded a premium of 1.50c per pound over the current market for Prime Western; Special High Grade 1.75c effective Apr. 1, 1960.

(f) Prime Western delivered where freight from E. St. Louis exceeds 0.500c.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points (almost all U. S. lead is corroding grade).

(c) The daily silver quotations reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver 999 fine as made to Handy & Harman for nearby delivery at New York by regular supplies in quantities sufficient to meet daily requirements, and it is usually 0.250c below the price of which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5c per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis 999 fine.

(d) U. S. Treasury's gold price is $35. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

July 1960	Silver (c) New York	Silver London	Sterling Exchange	Gold (d) London
1	91.375	79.250d.	280.6620	250s. ¾d.
4	Holiday	79.250d.	Holiday	250s. ¾d.
5	91.375	79.250d.	280.7733	250s. ¼d.
6	91.375	79.250d.	280.9000	249s. 11¼d.
7	91.375	79.250d.	280.9520	249s. 10d.
8	91.375	79.250d.	280.8420	249s. 10¾d.
11	91.375	79.250d.	280.8500	249s. 11¼d.
12	91.375	79.250d.	280.7100	249s. 11¼d.
13	91.375	79.250d.	280.8020	250s. ¼d.
14	91.375	79.250d.	280.8500	250s. 0d.
15	91.375	79.250d.	280.8500	249s. 11½d.
18	91.375	79.250d.	280.8725	249s. 10¾d.
19	91.375	79.250d.	280.9540	249s. 10½d.
20	91.375	79.250d.	280.9860	249s. 10¾d.
21	91.375	79.250d.	280.8966	249s. 10¼d.
22	91.375	79.250d.	280.8240	250s. 0d.
25	91.375	79.250d.	280.8700	250s. ¼d.
26	91.375	79.250d.	280.7480	250s. 1¼d.
27	91.375	79.250d.	280.7940	250s. 1½d.
28	91.375	79.250d.	280.8300	250s. 1¾d.
29	91.375	79.250d.	280.8700	250s. 2¼d.
AVERAGES FOR MONTH				
July	91.375	79.250d.	280.842	—
AVERAGES FOR WEEK				
July				
6	91.375	—	280.749	—
13	91.375	—	280.831	—
20	91.375	—	280.903	—
27	91.375	—	280.827	—

Calendar Week Averages: New York Silver: July 1—91.375; July 8—91.375; July 15—91.375; July 22—91.375; July 29—91.375.

MARKETS (*Continued*)

London Metal Exchange Quotations

July 1960	Copper Cash Bid	Copper Cash Asked	Copper 3 Mon. Bid	Copper 3 Mon. Asked	Lead Current Month Bid	Lead Current Month Asked	Lead 3 Mon. Bid	Lead 3 Mon. Asked	Zinc Current Month Bid	Zinc Current Month Asked	Zinc 3 Mon. Bid	Zinc 3 Mon. Asked	Tin Cash Bid	Tin Cash Asked	Tin 3 Mon. Bid	Tin 3 Mon. Asked
1	254	255	244	244½	71⅜	71⅝	72½	72⅝	90¾	91	90¼	90¼	812	813	803	804
4	252½	253	243¾	244¼	71¼	71½	72	72¼	90⅝	90½	89⅝	89⅞	806	807	797	797½
5	253	254	243	244	71½	71⅝	72¼	72⅝	89½	89¾	89¼	89⅝	808½	809	798	798½
6	253½	254	243¾	244	71¾	71⅞	72	72¼	90	90¼	89½	89¾	809	810	799½	800
7	255	255½	244¼	244½	71½	71⅝	72¼	72⅝	90½	90¼	89¾	89⅞	809½	810	801	801½
8	255¼	255½	245	245¼	71½	71⅝	72¼	72⅝	90½	90¼	89¾	89⅞	805½	806	797½	798
11	259	259½	250	250½	71⅝	71¾	72⅝	72½	90⅝	90½	90¼	90⅝	805½	806	799½	800
12	260	260½	251⅛	251¾	71	71¾	72	72⅛	90¾	90⅝	90⅛	90¼	805½	806	801	802
13	259	259½	251½	251¾	70¾	71	71¾	72	90½	90⅝	90¼	90⅝	808½	809	802	803
14	257½	258	249½	250	70⅝	70½	71¾	71⅞	90	90½	90	90½	809	810	805	806
15	252	253	245½	246½	70¾	71	71¾	72	90¼	90⅝	89⅞	90½	812	813	806½	807
18	252	253	246	246¼	70¾	70⅞	71⅝	71¾	90½	90¼	89⅝	89¾	810½	811½	808	809
19	255	255½	247¼	247½	71	71½	71¾	71⅞	90	90¼	89⅝	89¾	813	813½	810½	811
20	257	257¼	248	248½	71	71½	71⅞	72	90¾	91	90	90¼	818	818½	818	819
21	256¾	257	248½	249	71⅜	71½	72⅜	72½	91¼	91⅜	90¼	90⅜	823	823½	823	823½
22	249½	250	245½	246	71½	71¾	72	72⅛	90¾	91	89⅞	90	818½	819	818½	819
25	250	250½	246½	247	70⅞	71	71⅞	72	90¼	90½	89½	89⅝	815½	816	815½	816½
26	251	251½	246½	246¾	71½	71⅜	71⅞	72	90¼	90⅜	89⅝	89¾	818	818½	818	819
27	254¼	254½	248¼	248½	71¾	72	72⅜	72¼	90	90½	89⅜	89¾	818	818½	818	818½
28	252½	253	247	247¼	71¼	71½	71½	71¾	89⅜	89½	89⅛	89¼	815½	816	816½	817
29	251¾	252	246¾	247	71	71⅛	70½	71¼	88	88½	88¼	88½	815	815½	815	815½
Av'g's	£254.577		£246.970		£71.241		£72.030		£90.235		£89.795		£812.512		£808.488	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.9%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments, f.o.b. New York unless otherwise stated, tons of 2,000 lb unless otherwise noted. st—short ton; lt—long ton; stu—short ton unit; ltu—long ton unit. (p) duty extra.

MISCELLANEOUS METALS

July 31, 1960

Aluminum ingot, 99 plus % lb		28.1c
Antimony, spot, lb, less than carload, in cases		32.59c
In bulk, carload lots, f.o.b. Laredo		29.00c
Imported, 10 ton min. (p), 99% Duty not paid	22¾ —	23c
Bismuth, ton lots, lb		$2.25
Cadmium, ton lots delivered, lb		$1.40
small lots		$1.50
Calcium, lb, ton lots, 98%, cast		$2.05
Chromium, 97% grade, lb, contract delivered		$1.29
Cobalt, 97 to 99%, per lb effective 3-1-60		$1.50
Germanium, per gram, 10,000 gram lots	(d)28.15c—(c)(d)29.95c	
Indium, troy oz	$1.35 —	$2.25
Lithium, lb, 98%	$9.00 —	$11.00
Nickel, cathodes, lb (a)		74c
Other sales, regular sellers		74c
Sales by dealers, etc		74c
Magnesium, 99.8% carloads, lb producer's plants, Velasco, Texas, effective Apr. 16		35¼
Palladium, troy oz	$24 —	$26
Platinum, troy oz	$81 —	$85
Quicksilver, flask of 76 lb, 25 flasks or more	$209 —	$211
Selenium, 99 plus %, lb—(Feb. 19, 1958)	$6.50 —	$7
Silicon, minimum 98%, carloads, lb		19c
Semi Conductor grade, lb		$360
Tellurium, lb		$3.50
Thallium, 100 lb or more		$7.50
Titanium, 99.3% plus, grade A-1, max. 3% Fe, lb (b)	$1.50 —	$1.60

(a) Effective Dec. 6, 1956; including U. S. duty; (b) Effective Aug. 1, 1959. (c) Delivered; (d) f.o.b. plant.

METALLIC ORES

Beryllium ore, imported, 10% BeO, (b) stu; spot	$31.75 —	$32.50
term contracts	$34 —	$34.50
Chrome ore per long ton, f.o.b. cars Atlantic ports, dry: 44% Cr_2O_3 no ratio	(a)$19.75 —	$20.50
48% Cr_2O_3 3 to 1 ratio	$35¼ —	$38
Iron ore, Lake Superior, Lower Lake ports, lt		
Old Range bessemer		$11.70(e)
Mesabi bessemer		$11.60(e)
Mesabi non bessemer		$11.45(e)
Lead (Galena), 80%, Joplin, Mo., ton		$141.72
Manganese ore—Per ltu of Mn basis 48%, nearby positions, subject to premiums and penalties, c.i.f. U. S. ports import duty extra., (n)87c—90c. Long-term contract nominal.		
Molybdenum ore, 90%, per lb of Mo f.o.b. mines		$1.25
Columbium-Tantalum, per lb, combined oxides 10 to 1 ratio	$1.18 —	$1.25
Tungsten ore, per stu of WO_3:		
Foreign 60%, c.i.f. U. S. ports, duty extra	$20 —	$20.25
U. S. scheelite, f.o.b. mill	$24 —	$25
Vanadium ore, per lb of contained V_2O_5 f.o.b. mines		31c
Zinc ore, Prime, 60% concentrate, Joplin, Mo., per ton		$80

(a) Nominal. (b) c.i.f. U. S. ports.
(e) Effective 1958 shipping season.

METALLIC COMPOUNDS

Arsenous oxide (arsenic trioxide) lb, in bbl, carload lots N. Y. docks		4–5c
Cobalt oxide, 72½% to 73½%, per lb, effective Mar. 1, 1960	$1.15 —	$1.18
Copper sulphate, 100 lb. effective Nov. 6, '59		$13.00
Germanium dioxide, gm		16¾c
Molybdic trioxide, technical, per lb of Mo	$1.46 —	$1.47
Imported, including 37c duty	$1.75 —	$2.05

ALLOYS

Ferrochrome 65 to 70%, per lb of Cr, (4-9% C)		28¾c
Ferromanganese, 74 to 76%, per lb shipping point		11c
Ferromolybdenum, 58 to 64% Mo. lb of Mo contained	$1.50 —	$1.82
Ferrosilicon, 50% per lb of Si f.o.b. shipping point (3-1957)		14.60c
Ferrotungsten, 72 to 82%, lb of W contained		$2.15
Ferrovanadium, per lb of V delivered	$3.20 —	$3.40
Silicomanganese, max. 1½% C, lb contracts		11.6c
Spiegeleisen, per lt, 19—21% grade effective Jan. 22	$100.00 —	$102.50

NONMETALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (Canadian funds) ton:

Crude No. 1	$1,400–$1,725	Paper Stock	$120–$142
Crude No. 2	$750–$1,100	Waste	$75– $86
Spinning Fibers	$350– $565	Shorts	$22– $75
Shingle fibers	$180– $220		

Asbestos, f.o.b., Vancouver, B. C. (Canadian funds):

Crude No. 1	$1,522	Spinning fibers	$220–$787

Asbestos, Vermont, f.o.b. Morrisville:

Spinning fibers	$353– $408	Waste, stucco or plaster	$86
Shingle stock	$181– $218	Refuse or shorts	$41– $75
Paper stock	$120– $142		

Barytes, f.o.b. cars:		
Georgia, crude, per ton		$18
Missouri, 94%, $BaSO_4$, per st	$16 —	$18
Crude oil well grade, min. 4.3 sp gr, st (a)		$18
Imported, c.i.f. Gulf Ports, st	$16 —	$18
Bauxite, st, f.o.b. point of shipment:		
Domestic, crude, 50%, 8% Fe, 13% Si	(c)$12.25 —	$13.50
Imported metallurgical, per lt, f.o.b. Br. Guiana, 60% Al_2O_3, 6% SiO_2, 1.25% Fe, 1–1–60		$7.25
Feldspar, bulk ton; f.o.b. plants:		
Potash or soda feldspar, 200 mesh, ceramic grade	$17 —	$20.50
Glass feldspar, white, 20 mesh		$9
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$37 —	$41
60% effective CaF_2	$33 —	$36
Acid 97% concentrate, bulk, ton		$45.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00 —	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington		$46

Mica—Domestic, f.o.b. mines. Punch 7c—12c per lb according to size and quality. Sheet clear 1½x2 in. 70c—$1.10; 2x2 in, $1.10 to $1.60; 2x3 in $1.60—$2.10; 3x3 in, $1.80—$2.30; 3x4 in, $2.00—$2.60; 3x5 in, $2.60—$3.00; 4x6 in, $2.75—$4.00; 6x8 in, $4.00—$8.00. Wet ground, very fine, $140—$155 per ton, Bulk sales, dry ground; $30—$55 per ton. Scrap $20—$30.

Ocher, Georgia, ton in sacks	$26.50 —	$32.00
Sulphur, Mexican, for use in Mexico, metric ton, f.o.b. mines, depending on location	$21 —	$23
For export f.o.b. vessel, depending on grade	$20.50 —	$22

Actual prices received by U. S. producers approximate the Mexican export prices.

Talc, f.o.b. works, ton:		
New York, purified	$18.00 —	$20.00
Vermont, extra fine		$12.50
Tripoli, Missouri, ton:		
40-mesh, cream colored		$50.00

(a) Some restricted sales at $11.50, (b) Corrected. (c) Nominal.

IRON AND STEEL

Pig iron, gross ton, basic, Valley furnaces		$66.00
Steel, f.o.b. Pittsburgh, billets, net ton		$80.00
Structural shapes, Pa., Ala., etc., 100 lb	$5.30 —	$5.50

FALK Motoreducers driving log conveyor and refuse conveyor at the modern mill of The Bohemia Lumber Company, Culp Creek, Oregon.

FALK *all-steel* Motoreducers give you longer service life

Whether your load conditions are normal or heavy, the extra rigidity of all-steel construction (more than twice that of cast iron) maintains better alignment of revolving elements under load...a vital factor in prolonging the service life of gears and bearings.

And if your installations are subject to shock loads, or accidental external impacts, you're way ahead when you install Falk All-Steel Motoreducers. These rugged units do not destroy themselves by tearing off their feet under jamming overloads, nor are their housings subject to cracks which both dissipate the vital lubricant supply and allow revolving elements to get out of alignment.

All-steel construction is one of the built-in extras that you get in Falk Motoreducers. Others include: (1) inherently stronger gear teeth (by AGMA standards), thanks to exclusive Falk extra-depth, high pressure angle helical gears; (2) maximum mechanical efficiency (98½% per gear mesh, under full load); (3) your choice of standard units (horizontal, vertical or right angle) to fit your precise requirements.

HORSEPOWER RANGE: to 75 hp . . . STANDARD OUTPUT SPEEDS: 780 rpm (high) to 1.2 rpm (low).

Prompt delivery from distributor stocks, or from warehouse or factory. Ask your Falk Representative or Authorized Falk Distributor for ***Bulletin 3100.***

THE FALK CORPORATION, MILWAUKEE 1, WIS.

MANUFACTURERS OF QUALITY GEAR DRIVES AND FLEXIBLE SHAFT COUPLINGS

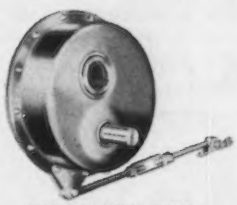
Representatives and Distributors in most principal cities

FALK

...a good name in industry

Take your choice of all-steel drives when you specify Falk

THE FALK ALL-MOTOR MOTOREDUCER ...the original All-Motor unit

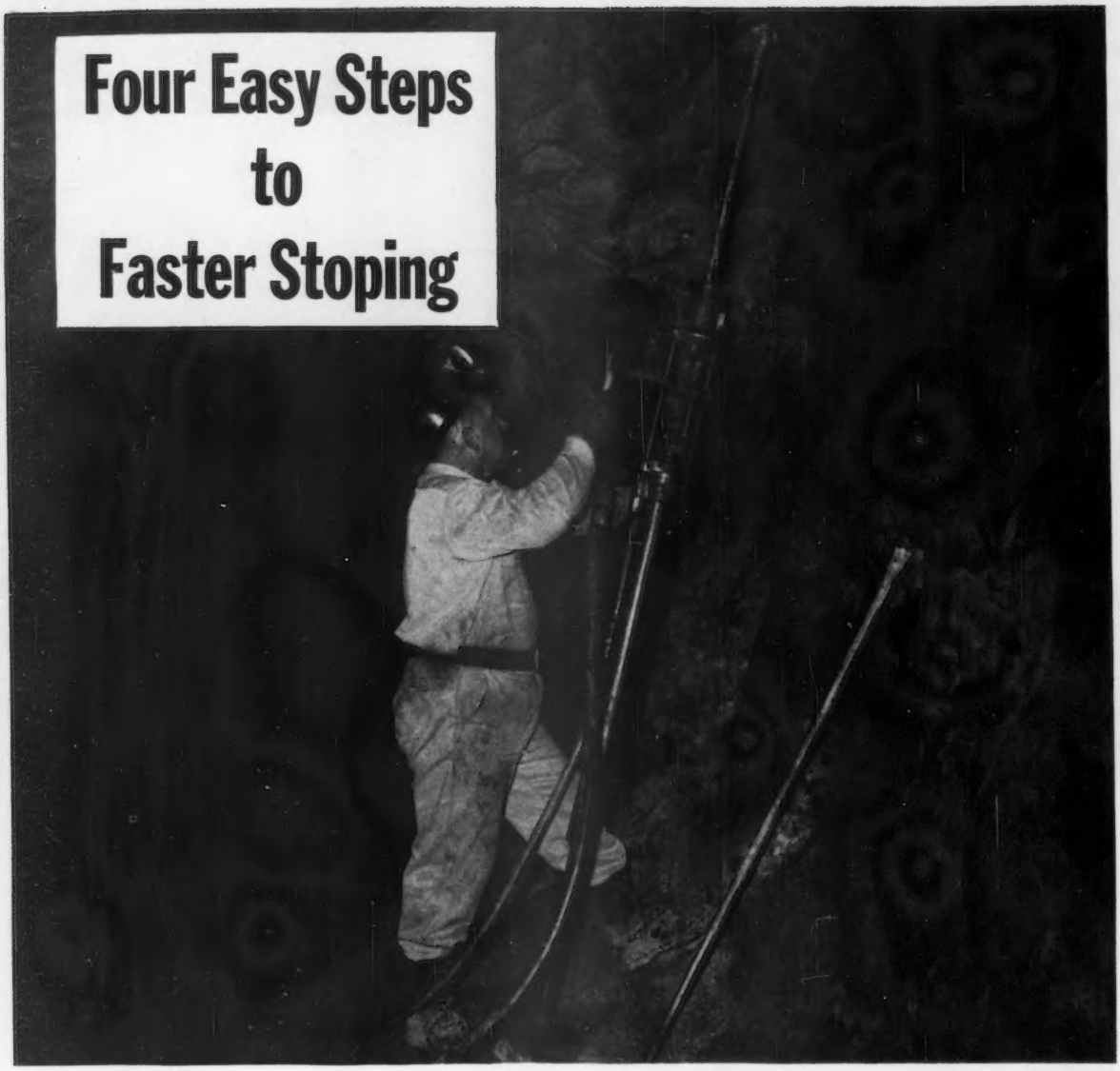


THE ALL-STEEL FALK SHAFT MOUNTED DRIVE

Torque ratings to 44,000 lb-in at low speed shaft. Also available in flange-mount design.

FALK and ALL-MOTOR are Registered Trademarks.

Four Easy Steps to Faster Stoping



	Gardner-Denver Model	R68	RB94*	RB104*
1. Choose the drill size you need	Hammer diameter	2⅝	2¾	3⅛
2. Take your choice of feeds	Direct feed (steel)	X	X	X
	Direct feed (aluminum)	X	X	X
	Telescopic direct (aluminum)	X	X	X
	Reverse feed	—	X	X
3. Specify the chuck to match your steel	Collared chuck	X	X	X
	Tappet chuck	X	X	X
4. Add the type of controls you prefer	Push-button control	X	X	X
	Rotary control	X	X	—
	Stop rotation control	—	X	X

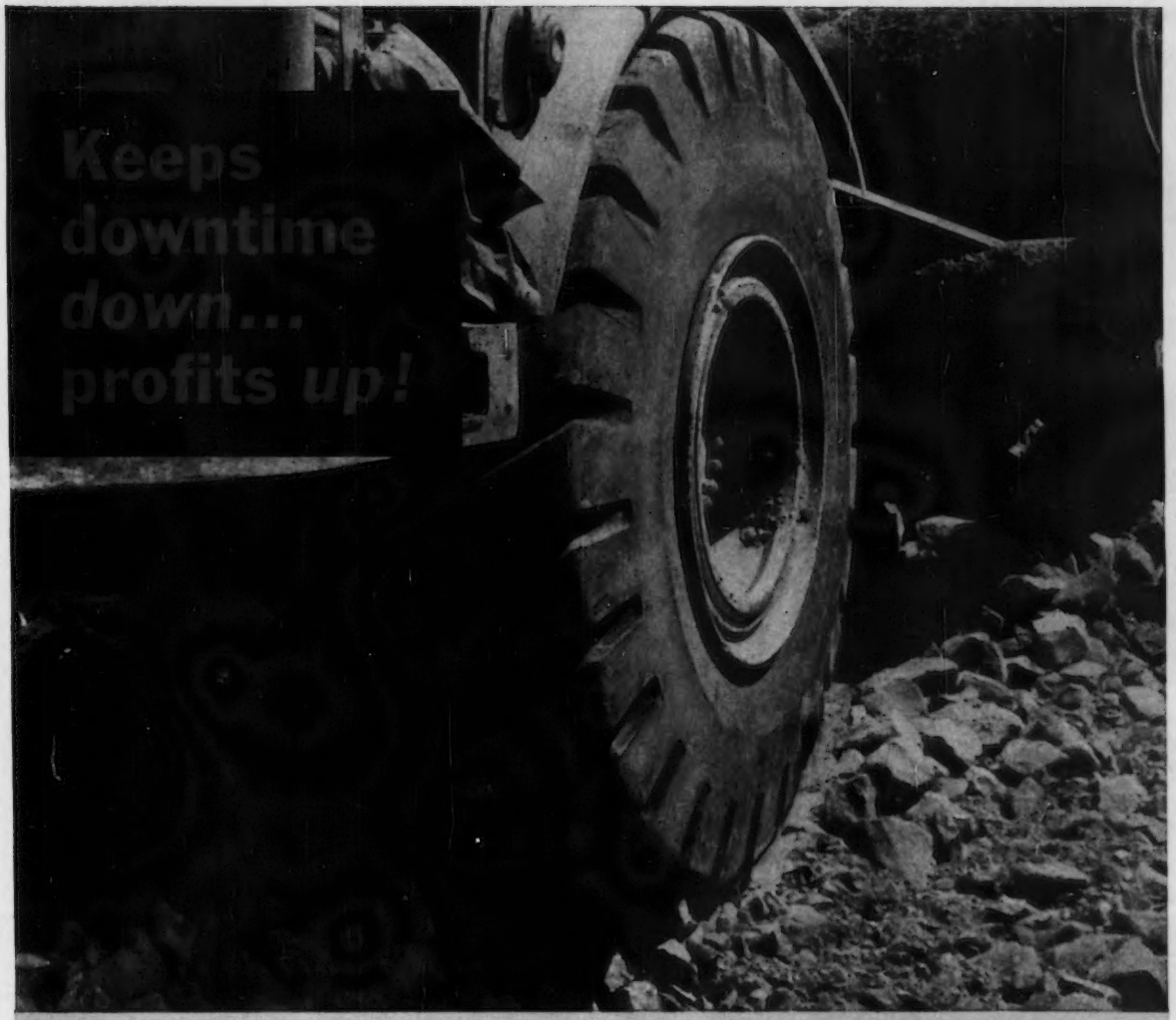
Gardner-Denver stopers hit hard, are easy to handle, stay on the job with minimum maintenance. All have automatic water control—operate in "water on, air on . . . air off, water off" drilling cycle. Ask your Gardner-Denver mining equipment specialist for details. Write for bulletin.

*Roof-pinning models available—drill holes, drive studs and tighten nuts quickly, efficiently.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois
International Division, 233 Broadway, New York 7, New York
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario



NYGEN-BUILT

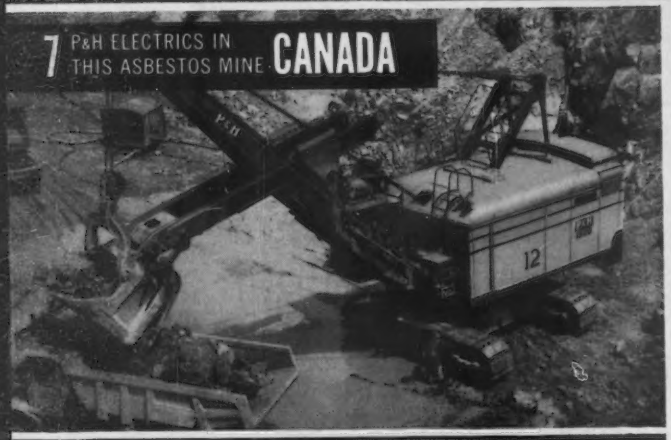
GENERAL TIRES

stay on the job 'til it's done to assure most profit per project

Built with exclusive Nygen cord, General Off-the-Road tires are the one sure way to protect and build job profits. Nygen cord construction means extra protection from costly in-the-field damage. And General's deep-digging, high flotation treads keep rolling whatever the going. From now on, be sure of less downtime, more profit . . . with Nygen-built General Tires on your units.

THE GENERAL TIRE & RUBBER CO. • AKRON 9, OHIO

12 P&H ELECTRICS IN THIS COPPER MINE PERU
12
P&H


7 P&H ELECTRICS IN THIS ASBESTOS MINE CANADA
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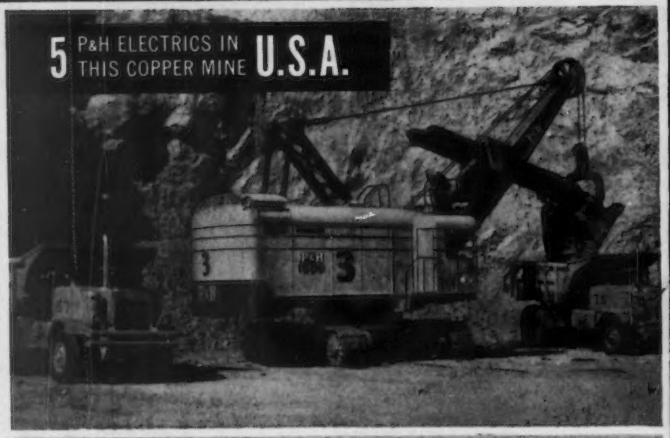

5 P&H ELECTRICS IN THIS COPPER MINE U.S.A.
3
P&H
3

4 P&H ELECTRICS IN THIS IRON MINE U.S.A.
P&H
1400
9
47

9 P&H ELECTRICS IN THIS NITRATE MINE CHILE
P&H
1400
7

Throughout the Americas...

More mines are STANDARDIZING on

P&H ELECTRIC SHOVELS

...more evidence that one P&H always sells another

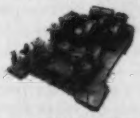
Look at the evidence: Count the P&H Electric Shovels now in use in each of the mines shown here. It's the same story you'll find in mine after mine: once a P&H electric shovel is on the job, performance records show production increases and lower unit costs that simply make it good business to standardize on P&H. Because more mines are following this trend, Harnischfeger now is the world's largest builder of full electric and diesel-electric shovels.

P&H Electric Shovels incorporate many dramatic new design fundamentals which make them different from all others.

Foremost is MAGNETORQUE® drive—the exclusive *patented* hoist drive that puts more material into the dipper, faster—with every pass! It is the most productive digging motion drive known for electric shovels, producing higher bail pull, greater dipper fill factor and automatic impact protection for the hoist machinery.

FIVE EXCLUSIVE P&H FEATURES

MAGNETORQUE DRIVE
Electro-magnetically transmits full digging power of A.C. motor direct to dipper—without motor generator set conversion to D.C. current.



FULL WELDED STEEL CONSTRUCTION
Unit-welded rolled steel design pays dividends in exceptionally long shovel life in hard digging.

ENCLOSED HOIST MACHINERY
No open gearing—all power trains for hoist, swing and propel drives are enclosed in oil-tight gear cases.

INDEPENDENT CRAWLER PROPEL MOTION
P&H gives you independent motors for each function—the basic principle of electric shovel design and purpose.

HIGH STRENGTH T-1 STEEL
Only Harnischfeger uses it as *standard* in fabricating a boom and dipper handle with highest impact absorption ability.

Another major reason why "One P&H Always Sells Another" is single-source responsibility for service. Harnischfeger is the only shovel manufacturer which makes its own electrical as well as mechanical components—all designed and matched by a single manufacturer *specifically for balanced electric shovel production cycles.* For more information write Harnischfeger Corporation, Milwaukee 46, Wisconsin.

HARNISCHFEGER
Milwaukee 46, Wisconsin

P&H
CONSTRUCTION & MINING DIVISION

Solids by pipe...

Can you meet the challenge of this new day in bulk transportation?

Will you be in the running when the pipeline industry's biggest new job starts taking shape?

Solids by pipeline is no longer a dream. It's a highly successful reality.

Gilsonite . . . coal . . . *what raw material will be next* to start moving to market through a pipe?

As you get set to meet the mighty challenge and opportunity that solids pipelining presents to your industry, remember this:

1. Men who engineer solids pipeline systems find that *uniform concentration* of solids is a must in a pipelined slurry.
2. You can get the slurry uniformity you want—with LIGHTNIN Mixers.

LIGHTNIN Side Entering Mixers keep 700 tons of solids per day uniformly suspended for dispatch through the pioneer American Gilsonite Co. pipeline. LIGHTNINs in thousands of chemical plants mix slurries of every kind, rapidly, dependably—*to the exact level of uniformity needed.* If it can be slurried, you can slurry it *uniformly* with LIGHTNINs.

If you'd like quick, competent help on slurry suspension for a specific project, call in your LIGHTNIN Mixer representative now. He's listed in Pipeline Composite Catalog. Or write us in confidence.

Good mixing helps move Gilsonite over a mountain

Solids pipeline built by American Gilsonite Co. makes the refining of gasoline from Gilsonite economically possible. It saves more than $4 per ton—a million dollars a year—over other methods of transporting Gilsonite ore over a mountain from mine to refinery.

American Gilsonite's 6-inch pipeline carries slurries averaging 38% solids and 62% water at 350 gallons per minute. It delivers more than 700 tons of solids per day at the downstream end, 80 miles from the eastern Utah mine.

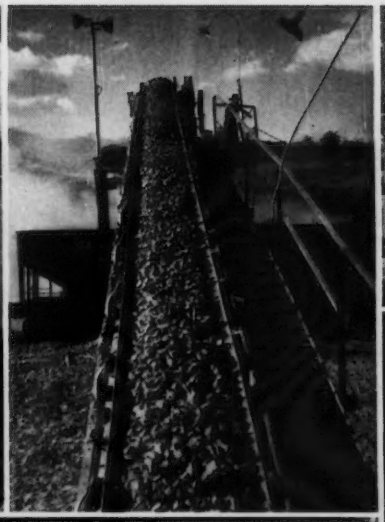
Cut from the solid vein with high-pressure jets of water, the shattered ore is flumed more than a mile underground to the bottom of the 800-foot-deep central shaft.

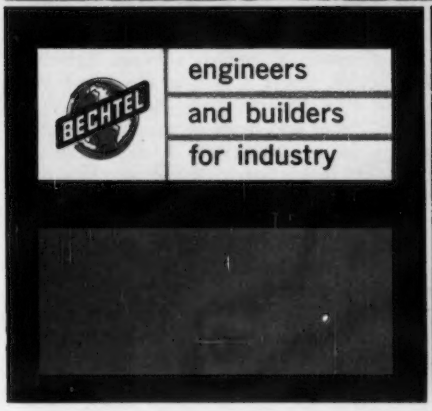
Then the ore is screened to 8-mesh maximum, pumped to the surface with fluming water, and mixed to uniformity in 200,000-gallon holding tanks equipped with LIGHTNIN Side Entering Mixers.

Lightnin® Mixers MIXCO fluid mixing specialists

MIXING EQUIPMENT Co., Inc., 234-h Mt. Read Blvd., Rochester 11, N.Y.

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave.; Toronto 10, Ont.





Bechtel Experience permits

GUARANTEED COSTS AND COMPLETION DATES

for Mining and Metals Projects

Bechtel experience—covering all commercial metals and the facilities for their production and handling—offers important advantages to those who are planning new or expanded mining or metal processing operations:

1. Services that meet *all* project requirements, minimizing the burden on the client's executive and supervisory personnel. Services include... engineering and economic studies... design and detailed engineering... construction—or management of construction ... purchasing, inspection and expediting of materials and equipment;

2. Experienced personnel capable of start-up and preliminary operation of plant and of training local personnel for permanent operation;

3. Guaranteed project costs and completion dates.

In the last eighteen years, Bechtel has been responsible for design, engineering and construction of some of the most important mining and metals projects in an area extending from the Arctic Circle to the tropics.

Assignments successfully completed include open pit mines, reduction works, beneficiation plants, concentrating plants, and the plant site communities, ports and handling and shipping facilities required in their operation. *Inquiries are invited.*

BECHTEL CORPORATION

SAN FRANCISCO · Los Angeles · New York · Houston

CANADIAN BECHTEL LIMITED

Montreal · TORONTO · Calgary

WESTINGHOUSE PROGRESSIVE AUTOMATION CAN HELP YOU ACHIEVE PLANT FLEXIBILITY, INCREASED POWER EFFICIENCY FOR SMELTING AND REFINING

Changes in electrochemical processing techniques represent the major problem confronting the industry. How to utilize existing facilities when newer production processes are developed . . . and how to optimize profits from the present plant investment are other problems.

Westinghouse is ready to help you plan *economical steps* to automatic production to achieve your goals without over- or under-automating. Westinghouse Progressive Automation is an individualized plan to gain higher product quality through step-by-step control of operations . . . a long-term plan with minimum capitalization.

Rapid growth of the metal mining industry finds many electrical systems badly overloaded without adequate protection . . and narrowly limited in adaptability to changing electrical needs. D-c power requirements in the production of aluminum, copper, magnesium and other metals call for reliable and economical equipment to convert a-c power to d-c power in very large blocks. Powering-Up with an adequate electrical system is a logical first step on the road to Progressive Automation.

To provide more efficient means of supplying the large blocks of direct current, Westinghouse developed the silicon rectifier for all voltages. As compared to other types of rectifiers, the high efficiency of the Westinghouse silicon rectifiers permits power savings of $50,000 in a typical installation rated at 100,000 amps, 300 volts d-c. Recently, Westinghouse installed the world's largest silicon rectifier unit (rated 10,000 amps, 600 volts d-c) for a large aluminum producer.

Automatically regulated furnace transformers, to supply the exacting and varied current and voltage requirements in electrometallurgical and electrochemical operations, are a next step in Progressive Automation. Furnace transformers are subject to frequent short circuits which cause heavy current surges and high mechanical stresses. Westinghouse furnace transformers are designed to handle these conditions and give uninterrupted service.

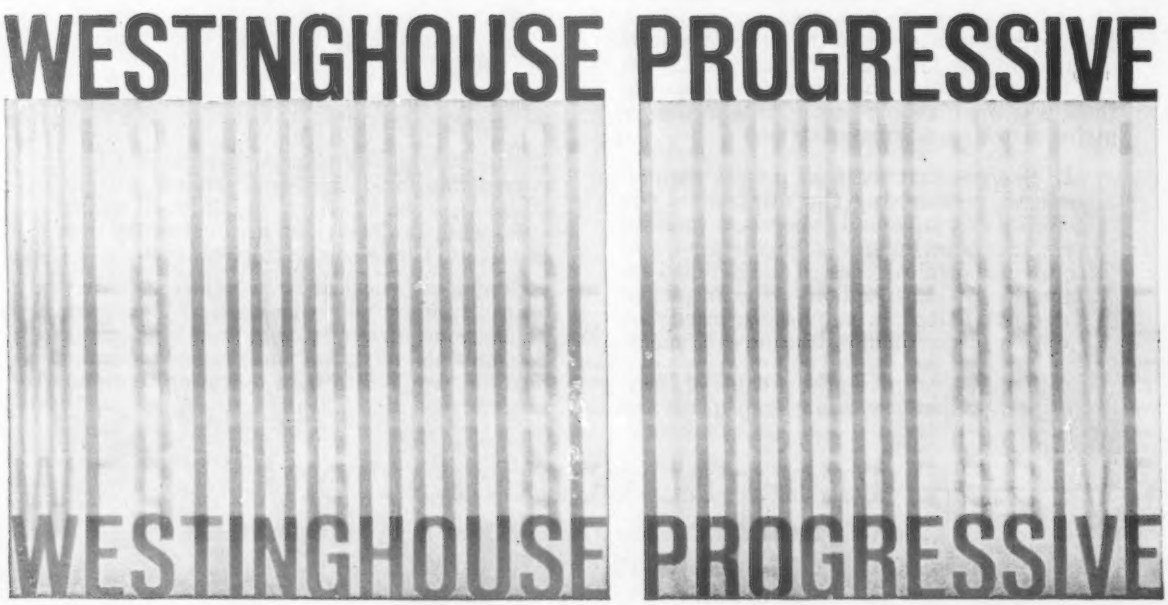
For drive requirements, reliable Westinghouse motors provide efficient power. Consider the five bonus values of the new F/A Motor: fully accessible . . . inspection is faster, easier and more complete than ever before; inherently quiet . . . housing is isolated from the stator; Thermalastic® insulation . . . for long life and protection of coils; same reliable basic components; easy to connect.

* * *

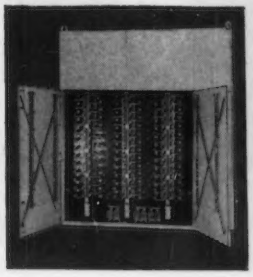
Westinghouse Progressive Automation is a step-by-step plan toward gaining higher product quality. Carried to its logical conclusion, it can mean eventual coordination of all production variables under a digital computer.

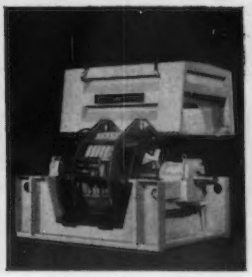
Today, there is one source for all electrical equipment for the metal mining, smelting and refining industries. Call your Westinghouse representative for complete information on PROGRESSIVE AUTOMATION.

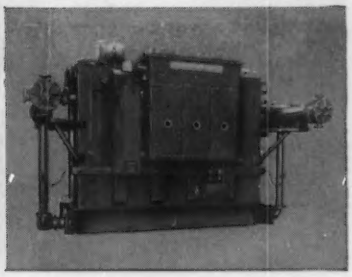
J-96143



(Top) Flotation cells, where heavy-duty electrical power is required to constantly mix oil and air with the water and ore. (Lower left) Silicon rectifier unit. (Center) New Westinghouse F/A Motor. (Lower right) Furnace transformer.



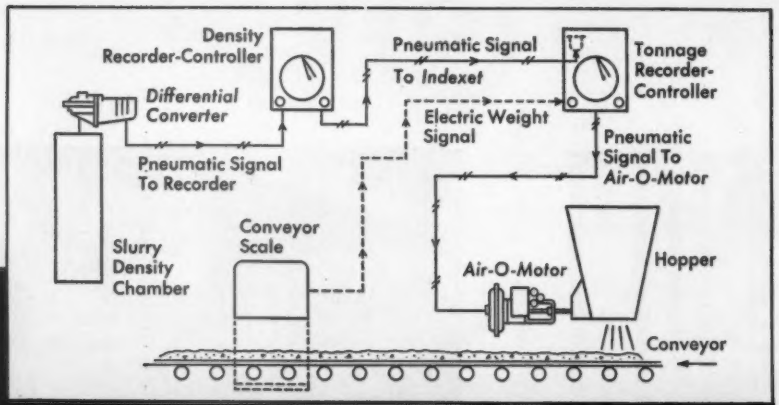


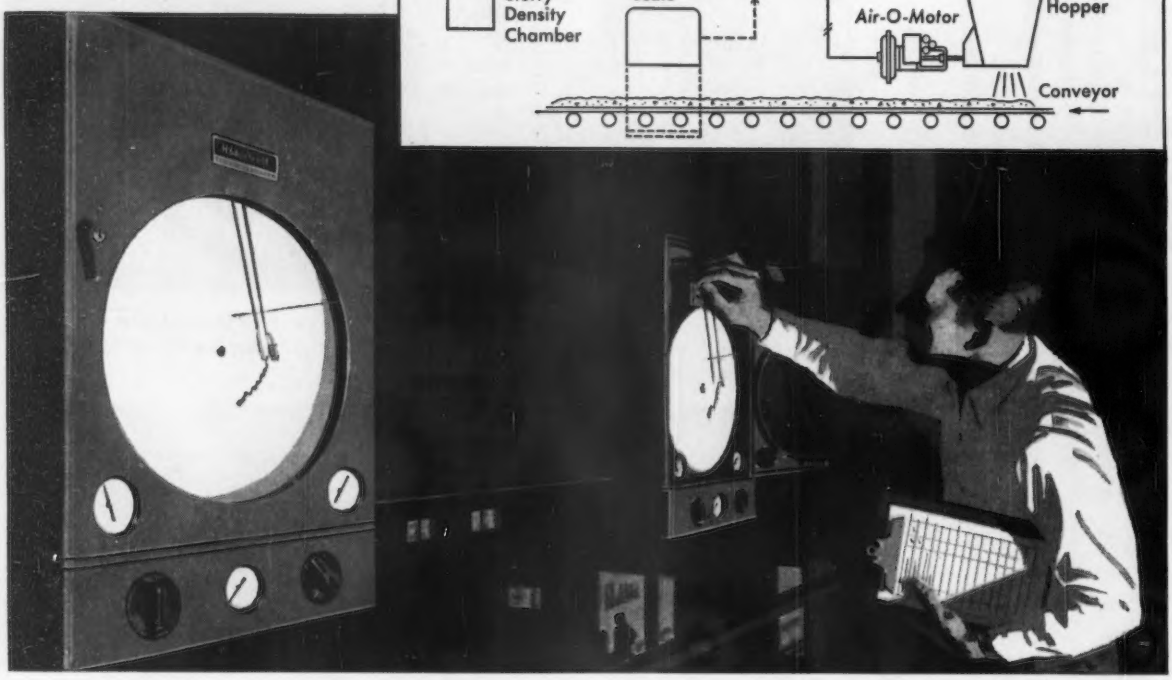


AUTOMATION

YOU CAN BE SURE...IF IT'S Westinghouse

Metallurgist at American Smelting and Refining Co. adjusts recorder-controllers that automatically maintain constant density of copper slurry by varying tonnage fed to ball mill.





Copper slurry density held within ± 0.2% with Honeywell controls

American Smelting and Refining Co., Silver Bell, Arizona, gets excellent classification of copper slurry . . . holds tonnage and copper recovery high by keeping slurry density constant with a Honeywell control system.

Copper-containing ore is mixed with water in a ball mill, and the overflow is pumped to a cyclone classifier. Overflow from the classifier is fed to the flotation section, where the copper is floated off. Between the classifier and flotation section, slurry density is measured by a displacement unit. A *Differential Converter* transmits the density signal pneumatically to a recorder-controller. This instrument, in turn, transmits a pneumatic signal to the *Indexet* unit which automatically positions the set point index of a tonnage recorder-controller. The tonnage controller is actuated by a conveyor scale on the ore conveyor, and operates a pneumatic *Air-O-Motor* actuator on the gate of the hopper feeding the conveyor. While the tonnage controller responds primarily to weight on the conveyor, it is influenced, through the density controller and *Indexet* unit, to add more ore from the hopper when slurry density is not high enough.

Your nearby Honeywell field engineer can help you profitably apply these controls and Honeywell instrumentation for many other metal production processes. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

75th YEAR
PIONEERING THE FUTURE

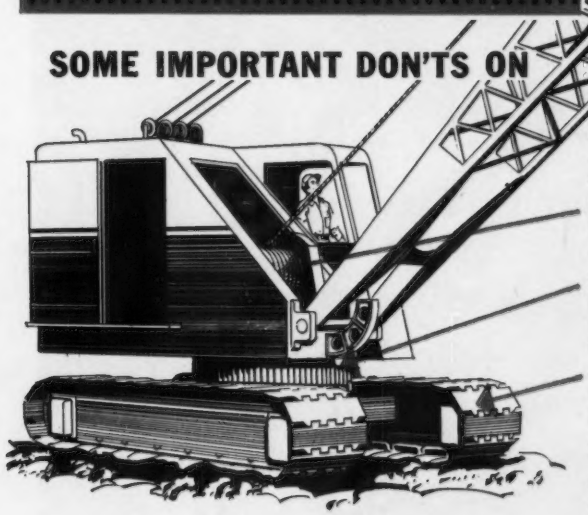
Honeywell

H HONEYWELL First in Control SINCE 1885

LUBE LOGIC

Three time and money savers

SOME IMPORTANT DON'TS ON POWER SHOVEL LUBRICATION

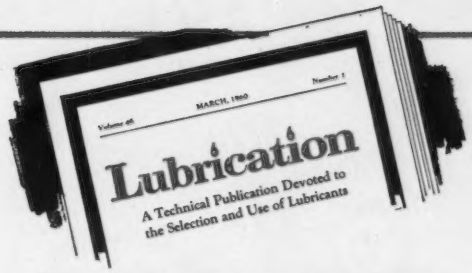


It's an old Texaco maxim that over-lubrication is sometimes worse than none at all, and there are three vital spots on power shovels where this is particularly true:

1) WIRE ROPE that winds onto drums fitted with clutches should be lubricated very sparingly; otherwise, the lubricant may get onto the clutch faces and cause slipping.

2) TURNTABLE ROLLER PATH should never be lubricated, unless it's the double-flange type with hook rollers. Lubricant will cause the rollers to slide and wear flat. Lubricate the bearings of turntable rollers sparingly to avoid drip on the turntable path.

3) TREADS, for instance, should never be lubricated at all. (We're talking about the tread only now; the track rollers or idling assemblies need very different treatment, which we discussed in the April/May 1960 Lube Logic). The pins that connect the individual treads are designed to operate without lubrication. Any oil or grease on these pins will pick up abrasive dirt which would act as a lapping compound on the pins and drastically shorten service life.



The whole truth about mobile lube rigs

What does it take to make a mobile lube rig? What do you put on it? How do you use it? The questions have been coming in so fast lately that Texaco has devoted a whole issue of its magazine, *Lubrication,* to answering them: the March 1960 issue, titled "Mobile Lubrication Equipment."

Lubrication is a major factor in cost control, and lube rigs can be a major factor in thorough maintenance, so send for your free copy of the March *Lubrication.* Supply of these valuable booklets is limited, so if you want one, send in your request *now* to Texaco Inc., 135 East 42nd Street, New York 17, N. Y., Department EM-20.

End-of-shift is best fueling time

They say there's a time and a place for everything, and for refueling your equipment the best time is the end of each day's work. And here are two reasons why: End-of-shift fueling minimizes the possibility of fuel-tank rusting, because there's no room for condensate to form in a tank that's full of fuel. And tank-bottom sediment, stirred up by incoming fuel, has a chance to settle down overnight, so it won't be drawn into the fuel line.

TEXACO LUBRICATION ENGINEERS

If LUBE LOGIC doesn't solve your problems, call your local Texaco man. Anytime, all the time, he's your best source of money-saving lubrication ideas. Don't forget that "Lubrication is a major factor in cost control."
Texaco Inc., 135 East 42nd Street, New York 17, N. Y.

Tune In: Texaco Huntley-Brinkley Report, Mon. Through Fri.-NBC-TV

TEXACO

Throughout the United States
Canada • Latin America • West Africa

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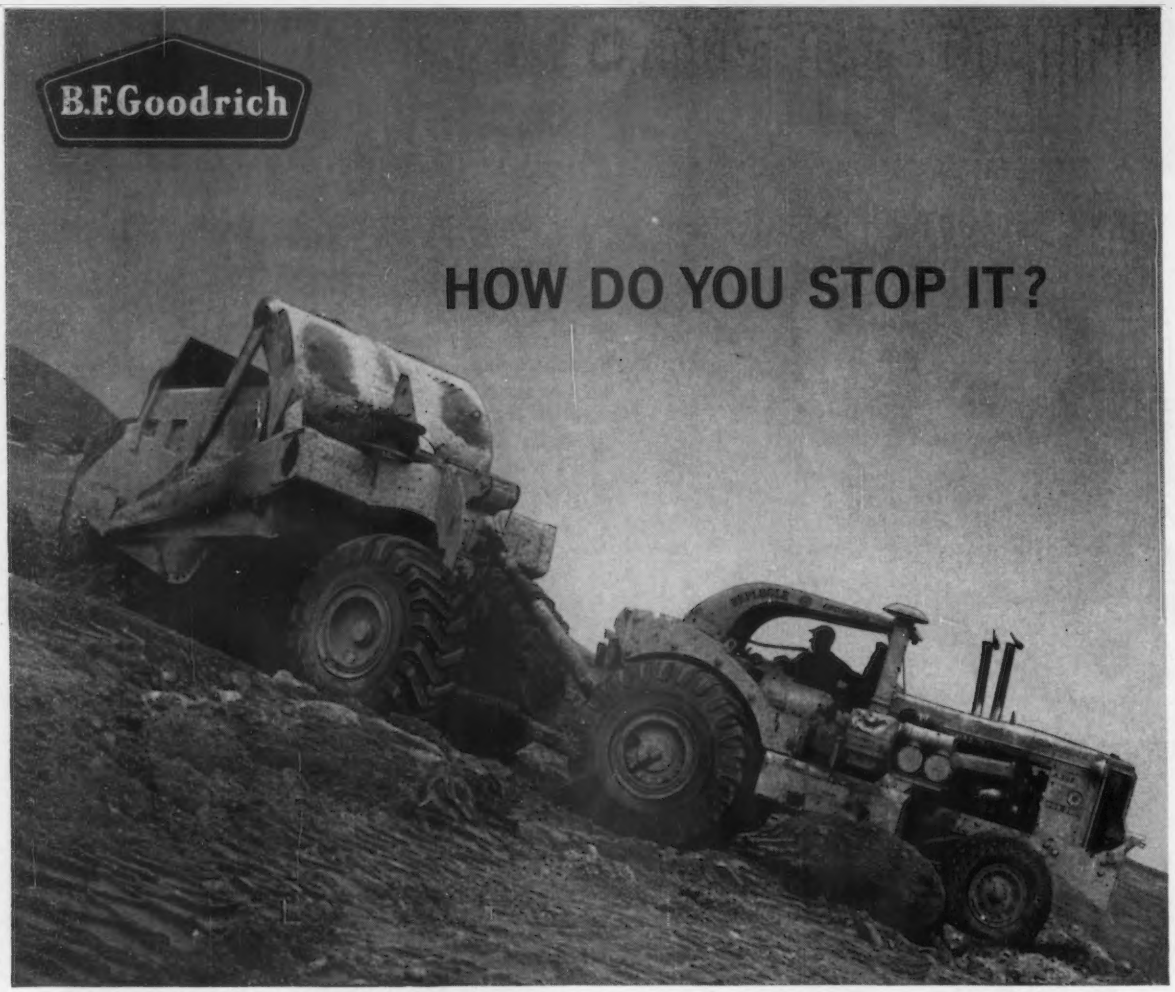

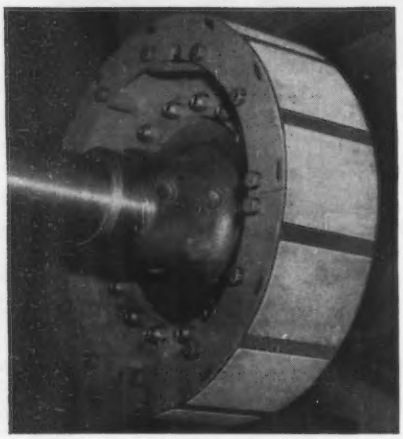

Hi-Torque brakes give uniform pressure, *full circle contact.* This provides maximum effective braking surface in the same size unit...double the braking power.

HI-TORQUE BRAKES!

B.F.Goodrich Hi-Torque brakes cut stopping distance approximately in half, compared to conventional two-shoe brakes tested on identical vehicles and loads. The added safety factor with these brakes means you can haul bigger loads more safely, operate on faster cycles. More difficult off-highway jobs can be tackled.

For *double the braking power* on your heavy weight vehicles, specify Hi-Torque brakes as original equipment. These brakes are now available on heavy dump trucks, tractor-scrapers, coal haulers, mine trucks and other big vehicles, from several manufacturers.

For complete information ask the manufacturer of your equipment, or write *B.F.Goodrich Aviation Products, a division of The B.F.Goodrich Company, Dept. EM-8, Akron, Ohio.*

B.F.Goodrich Hi-Torque brakes

Recover more of these minerals with Armour amine reagents ...for as little as 7¢ per ton of ore!

Spodumene
Ilmenite
Phosphate
Beryl
Cement Rock
Feldspar
Hematite
Kaolinite
Mica
Potash
Silica
Vermiculite

Armour cationic flotation reagents produce the fastest attachments to minerals known—selectively float more concentrate in less time, at less cost!

Increased recoveries of minerals listed here—plus greater throughput—are economically achieved with Armour flotation reagents. That's because the coating reaction between an Armour flotation reagent and the *specific* mineral you want is *instantaneous!* Armour-treated minerals then attach to rising air bubbles quickly, firmly.

You use less equipment too, because the sharp selectivity of Armour cationic flotation reagents enable you to recover minerals without using an extra cleaner flotation step. You can float minerals from one ton of ore for as little as 7¢!

Armour—first to develop the use of cationic chemicals in flotation—continues to lead the way toward improved methods of applying these chemicals. Results of broad Armour research and experience are available in the 20-page booklet detailing the characteristics and advantages of cationic chemicals in flotation. Send coupon for informative booklet today!

® *Leading Specialists in Cationic Flotation Chemicals*

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Please send me

"Mineral Flotation with Armour Cationic Chemicals"..... ☐

Sample for floating_____

_____

Information on these minerals (listed above)_____

_____

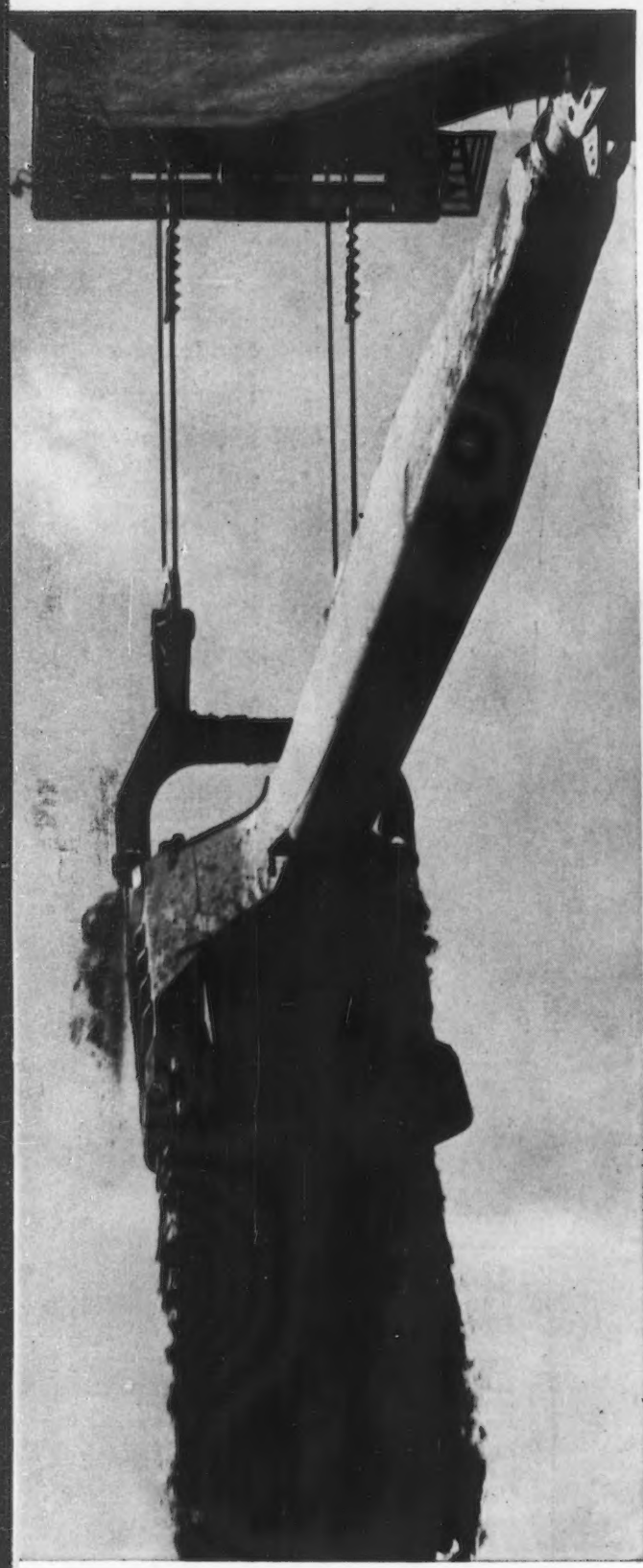
Name_____

Firm_____

Address_____

City_____ State_____

E-8



USS "T-1" Steel has

Impact abrasion resistance for long life.
5 times the life has been obtained from shovel bucket teeth and lips made of USS "T-1" Steel. In this case, the entire bucket and handle were built lighter, stronger and more durable because of the qualities of USS "T-1" Steel. Payload is increased and maintenance costs greatly reduced.

Weldability for low-cost field maintenance.
Shovel tooth being welded from USS "T-1" Steel plate. On-the-job maintenance for buckets, truck liners and other parts saves thousands of dollars annually. Buckets can be rebuilt without the use of expensive castings.

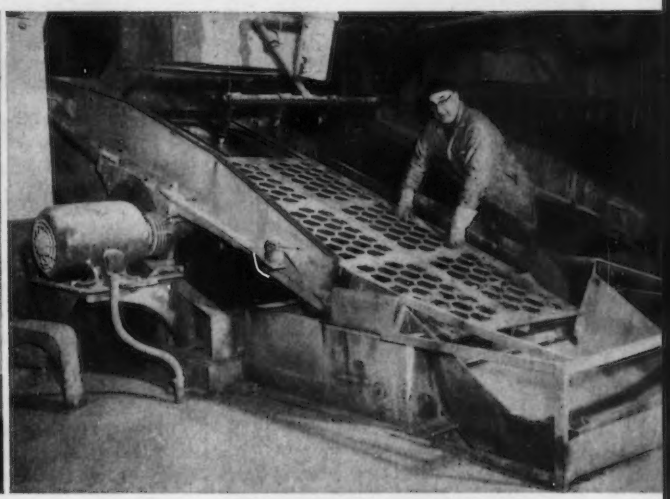
This mark tells you a product is made of modern, dependable Steel.

what you need to cut mining costs

USS "T-1" Steel is Mining's Metal

No other metal combines the qualities found in "T-1" Steel that make it so suitable for rugged mining equipment. It pays for itself many times over in longer life, ability to keep machines on the job. Even at temperatures down to 50 below zero, USS "T-1" Steel retains its toughness. For information on "How to Weld 'T-1' Steel," write to United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania. *USS and "T-1" are registered trademarks*

Strength for extra payload.
This is the world's largest dump truck. The body is built entirely of USS "T-1" Steel to haul 165 tons or 110 cubic yards. 12½ tons of weight were saved by utilizing the great strength of USS "T-1" Steel which has a minimum yield strength of 100,000 psi. Increased payloads of 25% are common for trucks and mine cars.



Toughness for reduced maintenance.
Vibrating screens, chutes and bins made of USS "T-1" Steel take the pounding and last many times as long as ordinary steel.

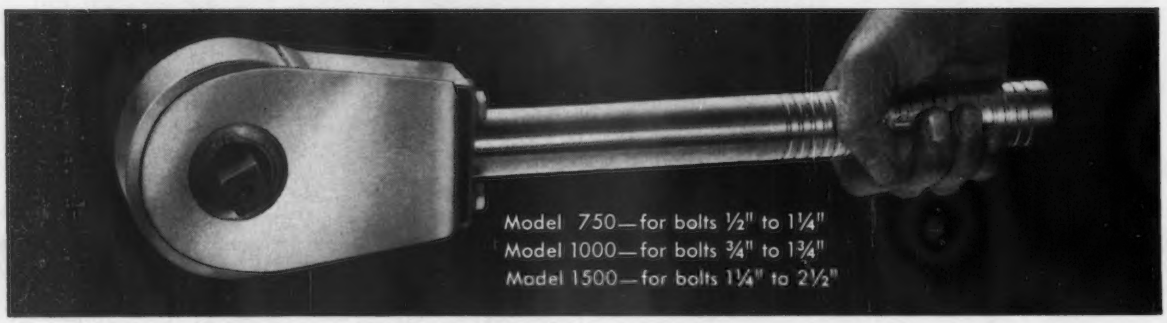
United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
National Tube—Pittsburgh
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company
United States Steel

USS

designed to solve a universal maintenance problem . . .

first manual impact wrench that works . . .
LOOSENS THE TOUGH NUTS
EVEN POWER WRENCHES CAN'T BUDGE!

SWENCH®



• Loosens "frozen" nuts in seconds • Tightens nuts to maximum practical tightness

There's never been anything like Swench before. It is an entirely new concept in wrench design. Swench is the world's *only manual impact wrench.* Here's what Swench means to you . . .

NEW SPEED—Nuts that previously had to be burned off can now be "Swenched off"—with unbelievable ease—by *one* man—in a matter of minutes.

NEW EASE—Only Swench in its torque class is truly portable . . . lets you take the wrench to the job—*anywhere*—with no auxiliary equipment, no power connections.

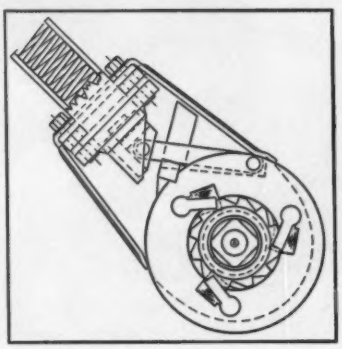
NEW SAFETY—With Swench there's no back-breaking, knuckle-knocking struggle . . . no dangerous handle extensions . . . no sudden release of a frozen nut . . . no shock transmitted through the handle.

NEW POWER—Swench, size for size, gives greater—and more effective—torque than power wrenches . . . multiplies torque applied to handle over 1500% (yet all Swench's power is built into the wrench itself).

NEW ECONOMY—Swench saves in *many* ways . . . no auxiliary equipment to maintain and man, no costly upkeep on the wrench, no man-hours fighting frozen nuts—*and* Swench costs less than half as much as wrenches with comparable impact power.

NEW VERSATILITY—*One* Swench can handle more bolt sizes than any power wrench . . . loosening or tightening requires no special adjustments.

NEW TENSIONING ACCURACY—Precise tightening is assured with Swench, following simple instructions.



INSIDE STORY—How is all this possible? Unlike power wrenches that deliver many tap-like blows, or ordinary manual wrenches that apply steady torque, Swench builds up power in its super-strong spring for a mighty wallop that is released as torsional impact every time the handle is advanced slightly more than 30 degrees.

Write for further information.

See for yourself! Swench is so different from anything you've experienced, you'll have to see it in action to believe it. For a quick and convincing demonstration, contact Marquette.

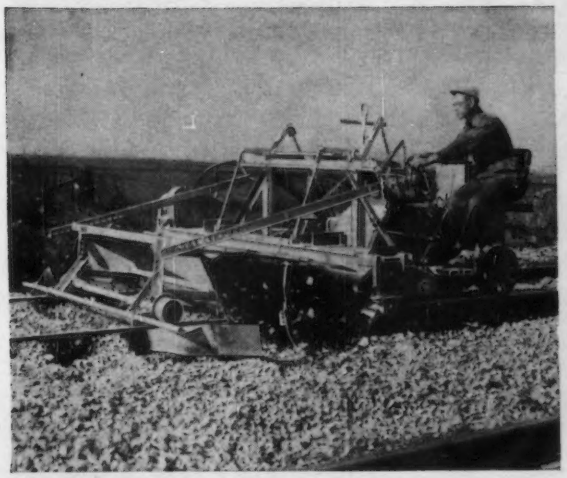
"When you're up against the tough nuts . . .
Don't wrench it . . . SWENCH it!"

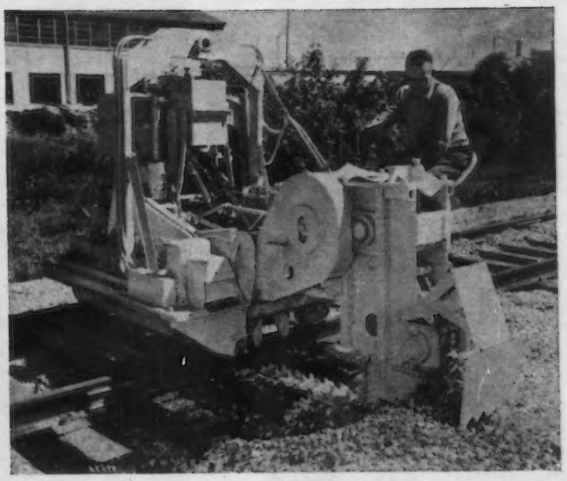
MARQUETTE DIVISION

CURTISS WRIGHT

CORPORATION • 1155 GALEWOOD DRIVE, CLEVELAND 10, OHIO

NEW PRODUCTS DIGEST





Nordberg Streamlines Its Track Cleaning and Cribbing Units (12)

TWO IMPROVED, self-propelled machines which add thoroughness and ease to track maintenance operations, were recently introduced by Nordberg Mfg. Co.

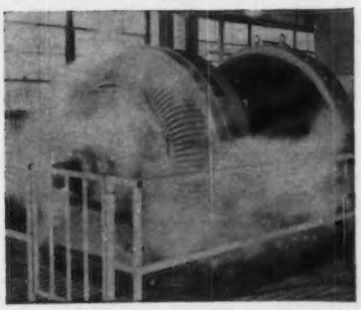
The first of the two, Nordberg's "Trak-Sweeper," is used to level ballast in the track and across the crib area for better ballast distribution ahead of the tamper and for removing excess ballast from the top of ties after tamping.

The other machine, called Cribex, which removes ballast from between ties or switch timbers, has been improved and is now available as a self-propelled machine for faster cribbing and one man operation.

Trak-Sweeper is hydraulically propelled with a "super low" working speed of approximately 10 ft per min and travel speeds of up to 15 mph. The rubber blades on the rotating impeller at the front of the machine are especially shaped to clean the rail base and can be easily adjusted to allow for wear.

The impeller is hydraulically raised and lowered for traveling or for varying ballast conditions. Two impeller speeds are used: slow speed before tamping and high speed for removing ballast.

Cribex's completely hydraulic self-propulsion unit moves it from crib to crib and permits the operator to "rock" the machine back and forth.



Fire Protection (10)

AUTOMATIC CARBON DIOXIDE fire protection systems have become Timken Roller Bearing Co.'s major defense against fires. Systems have been installed in all company plants in the U.S. and have been very successful in emergencies.

Timken's system works by substituting carbon dioxide for the oxygen surrounding a burning generator or motor. During one test, the gas discharge occurred all during the run-down time of the generator and for about 10 min after it had stopped. The discharge lasted approximately 20 min which is in accordance with the National Board of Fire Underwriters specifications.

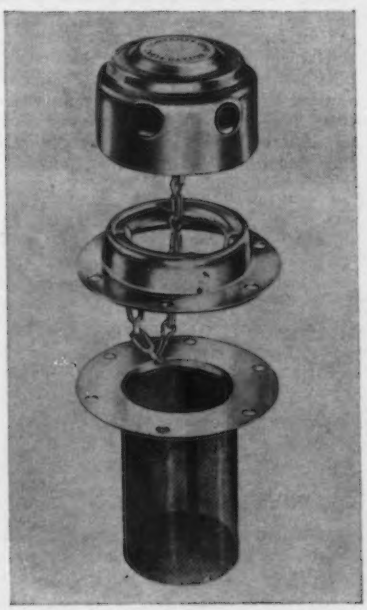
After the test was completed, the system was automatically reset for another operation.

There are sixty 50-lb cylinders of carbon dioxide set up in two separate batteries. Thirty are used in the initial discharge and a reserve of 30 is in readiness in case it is needed.

Corrugated Truck (7)

CORRUGATED BODY on KW-Dart Truck Co.'s model 35SL is rigid and durable, yet reduces the truck's weight by more than 4,000 lb—increasing its capacity from 35 to over 37 tons. Less weight also permits faster dead-heading and cuts down on fuel consumption.

Model 35SL has a 450 hp diesel engine, three-speed transmission and three-stage torque converter with downhill braking feature.



Filler Cap (14)

A NEW FILLER CAP with 30-mesh brass wire screen for hydraulic fluid and oil reservoirs has recently been introduced by the Lenz Co. This is, according to the company, one of the first filler cap as-

semblies that offers 30-mesh protection.

Breather caps are of vented type cadmium plated steel, with twist locking action that fastens securely into the flange.

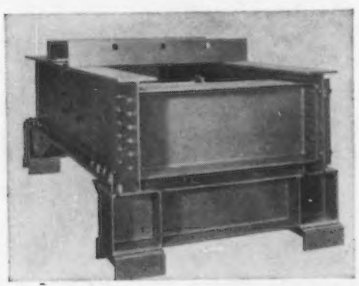
Lenz's screen is 3 in. deep and 1 5/16 in. in dia, and the assemblies are available with or without cap chain.

Ground Detector (13)

A SPECIALIZED DETECTING INSTRUMENT, called Faultfinder, is able to quickly and effectively locate accidental grounds—without shutting down operations—according to Parr Mfg. Co.

Faultfinder can work on either ac or dc power systems, up to 600 volts, and, since it imposes only two amperes on the circuit, cannot damage equipment on the line.

Unit is operated by one man and is convenient in detecting overhead cable, pipe and line signals and buried circuits without climbing or excavating. In some cases, Parr said, where it previously took up to three days to locate trouble, the Faultfinder has done the job in 20 min.



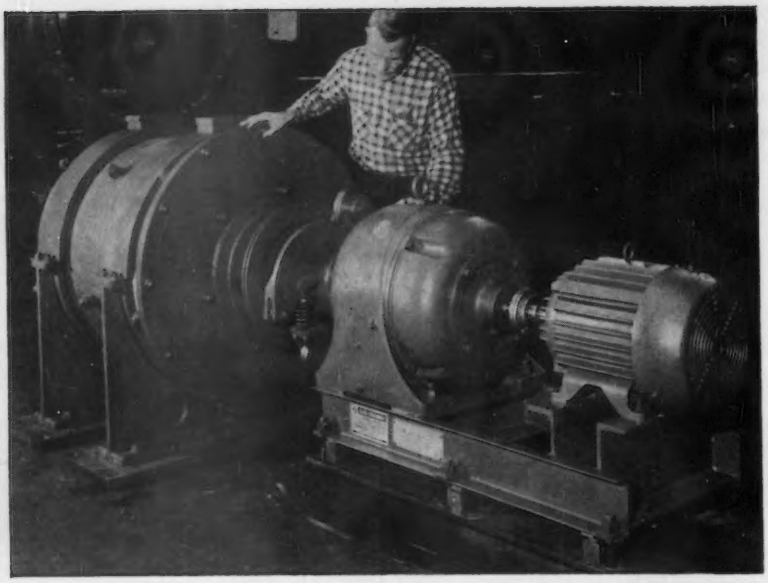
Car Shaker (6)

ALLIS-CHALMERS has streamlined its 3½-ton car shaker by fitting its self-contained, completely sealed two-bearing mechanism in the nodular iron housing within the body.

The unit (short center V-belt drive and 10-hp high starting torque motor) can be easily gotten to by removing one side plate.

The shaker body has extra-long, wide-faced shoes to fit any standard U.S. hopper-bottom gondola car and, to ease centering on car eaves, is balanced to hang level.

A-C said that the 3½-ton shaker is designed for fast, safe, economical push-button unloading of 10 cars or more per day.



Three-in-One A-C Unit is a Ball, Peripheral or Diaphragm Mill (11)

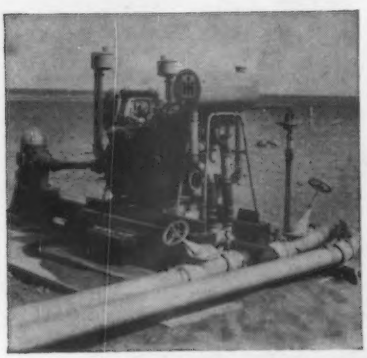
ALLIS-CHALMERS MFG. CO. has developed a grinding mill, the Trunducer, which incorporates three basic designs in a single unit. Utilizing a common component in conjunction with three different heads, the new Trunducer mill can be easily converted to operate as an overflow rod or ball, a peripheral discharge or a diaphragm mill.

The basic head, used on the overflow mill, is of flush covering surface construction with four discharge holes in a protruding discharge chamber. Spacers added to the shell's discharge end and an attached flat head with a stub shaft connected to the cable coupling, converts the unit to an end peripheral discharge mill with discharge between the spacers. A perforated plate added between the spacers and the shell transforms the machine to a diaphragm ball mill.

The mill is coupled to a triple reduction reducer through a cable coupling which transmits the torque from the reducer. This arrangement accommodates any degree of misalignment resulting from bearing wear. The shells ride on two bearings around the shell.

Engine Coolant (15)

COOLING SYSTEM for non-radiator cooled engines, said to be the most efficient under all operating conditions, was recently introduced by International Harvester Co.'s Construction Equipment Div.



The system, called FLO-MATIC, maintains a high-volume, high-velocity coolant flow, producing more uniform engine temperatures—service life of valves, pistons, piston rings and sleeves is, therefore, greatly reduced. Hot spot and steam pockets, the company said, are eliminated; and foaming and air entrainment problems, inherent with continuous-duty applications, are controlled.

At present, the FLO-MATIC system is available for three International V-8 engines (UV-401, UV-461 and UV-549) and three six-cylinder engines (UR-372, UR-450 and UR-501).

Coil Insulation (9)

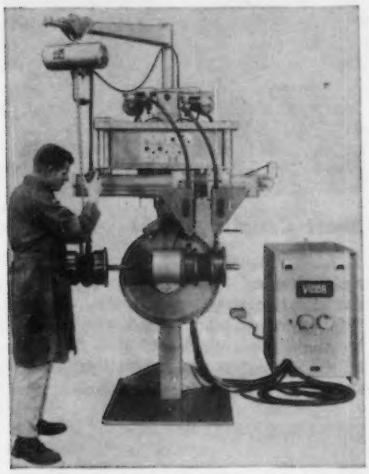
A NEW EPOXY INSULATION system for electric motor coils, known as Epa-Seal, has

been announced by the Crocker-Wheeler Div., Elliott Co.

Epa-Seal is applied to both random-wound and form-wound motors of 1 to 500 hp, which, C-W believes, is the first time that this epoxy insulation has been offered in motors of the higher horsepower ratings.

For form-wound motors, Epa-Seal is put on core and frame before winding. Slot cells are epoxy-glass, and coils are covered with glass tape, with slot sections protected by epoxy-mica wrapper. After all coils are installed, the entire wound stator undergoes the Epa-Seal vacuum-pressure process, which impregnates the coils, eliminates internal voids, and applies the epoxy resin to all external surfaces. Additional protection is given coils where leads enter.

For random-wound motors, the entire wound stator is encapsulated by a vacuum-pressure system that drives the epoxy resin deep into the coil slots, filling them completely. There are no voids; and the tough, resilient, impervious material encloses coils in a protective epoxy resin.



Roller Rebuilder (5)

AUTOMATIC REBUILDING of tractor rollers and idlers can be done smoothly with a new, lower-cost machine from Victor Equipment Co.

Victor Model B sells for less than two-thirds the price of the company's Model DEMS rebuilder, yet has the same double-wire feed, automatic move-over and motorized positioning of work. The main difference between the two types is that Model DEMS has a double-ended multiple spindle that mounts eight track rollers at a loading; Model B has a double spindle, mounts only two rollers or idlers.

Improved Crane-Excavator (19)

CRANE-EXCAVATOR, 22-B Series Two, has new and improved features designed to cut operating costs and boost production, according to the Bucyrus-Erie Co.

B-E said that the crane-excavator is available as a crawler, carrier or wagon mounted machine, fully convertible for crane, dragline, clamshell, hoe or shovel service.

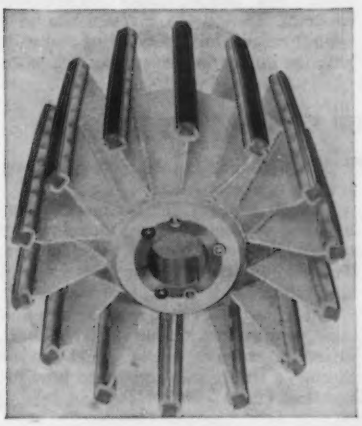
The company went on to say that longer machine life, trouble-free operation and minimum upkeep are obtained from improvements such as: adjustable hook rollers; splined horizontal propel

shaft; alloy bronze bearings for propel machinery; splined clutch for quick shift swing-propel; surface hardened gear teeth; remote control lubrication for swing gear and pinion; improved swing clutch bearing seals; and improved crawler frame construction with shielded rollers and bearings.

Rubber Belt Cleaner (23)

NEW RUBBER-LAGGED wing-type pulley, the TURN-CLEAN, which reduces build-up to greatly increase belt life, has been developed by Van Gorp Mfg. Inc.

Exterior edge of Van Gorp's wing is a U-shaped channel which holds a steel-encased rubber bar. It's this bar that keeps the belt clean—it tightly grips the belt and spalls off dried material from the conveyor underside, doing away with

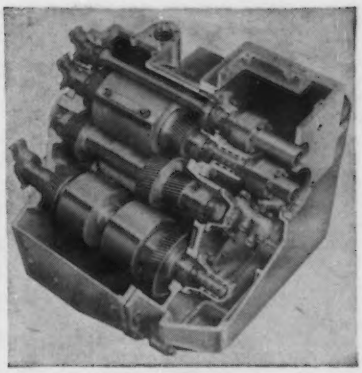


pulley-cleaning shutdowns at the head position as well as at the tail positions of belt conveying systems.

Van Gorp feels, therefore, that TURN-CLEAN will gain wide use in highly automated conveying systems that handle extremely sticky material or other materials that normally build up on belts and conventional type pulleys.

Eimco Transmission (22)

AMONG THE HIGHLIGHTS that the Eimco Corp. claims for its 103 Tractor Series is a four-speed countershaft transmission



combined with a single-stage torque converter and dual final drives to produce what the company calls the finest and most versatile power team it has ever made.

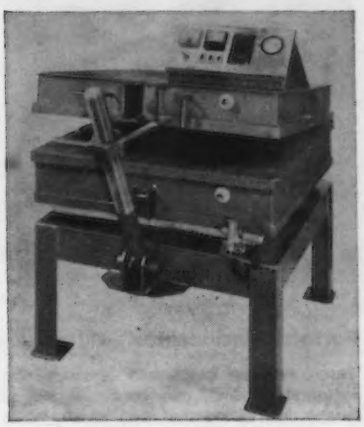
The compact and sturdy transmission has constant mesh gears that never reverse rotation—enables the operator to change the direction of rotation of either or both crawler tracks and change speed instantaneously without decreasing power or actuating a master clutch.

Heavy duty, single-stage torque converter is designed to keep engine torque in perfect balance with the load. This makes possible the full utilization of every available horsepower. According to Eimco, carefully supervised performance tests have shown that the Torque converter drive tractors can do more work on less fuel than can tractors with conventional drives.

Belt Vulcanizer (8)

ENTIRELY NEW type of belt vulcanizer and press which can exert pressure in excess of 50 tons and which has no mechanical, hydraulic or piston type pressure mediums, has been introduced by Vulcan Equipment Co.

The patented air bellows principle, "Vulcanbag," originally developed for Vulcan's mandrel type tire vulcanizers, is what makes the new model's performance possible—due to the bellow's large working area, tremendous force is obtained with a minimum of air pressure and supporting construction.



How to Take Red Tape Out of Maintenance (24)

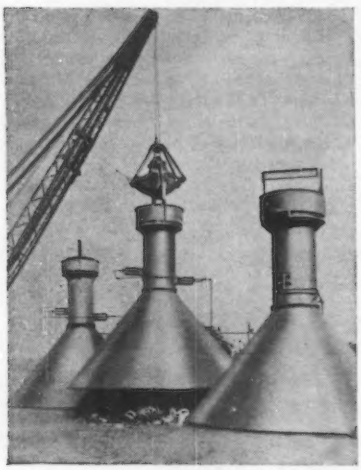
AN IMPROVED periodic equipment inspection program—Scheduled Maintenance—that's both simple and calls for a minimum of record keeping, has been developed by International Harvester Co.

Only three basic things are needed to carry out International's program—the operator's shift ticket, the scheduled maintenance control record and the actual inspection and report sheets.

The operator's shift ticket is filled out by the operator at the end of his shift and is a record of hours worked, final hour meter reading, loads handled and mention of any mechanical details needing attention. Systematic use of the shift ticket makes the solving of minor problems no more than one shift away.

Shift ticket data are transferred to the scheduled maintenance control record, which tells the exact hour meter reading of the next maintenance inspection and enables a forecast to be made of the approximate inspection date.

The actual inspection and record sheets are the final forms needed to round out International's maintenance program. Listing the maintenance in a natural order minimizes starting and stopping the engine and eliminates leg work.

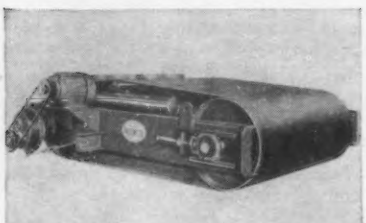


Portable Incinerator (21)

TRICO PROCESS CORP. has developed an incinerator which can be easily moved to any desired location, and which, while material is being burned, cuts out all offensive smoke and odors.

Though the portable incinerator was designed to reclaim large quantities of copper wire by burning off the insulation, Trico is now trying to extend its scope of application.

The after-burner section of Trico's unit uses gaseous fuel (either LPG, natural, mixed or manufactured) which is fed through a sturdy wire-reinforced hose for handling ease.

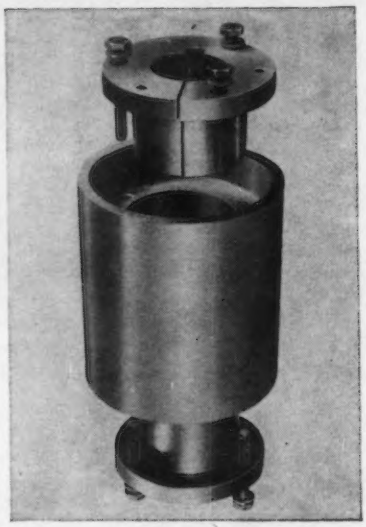


Tramp Iron Magnet (36)

MAGNETIC ENGINEERING & MFG. CO. has developed a powerful magnet, the WEMCO SE Series, for removing tramp iron from slag.

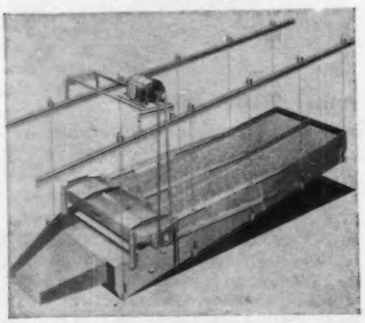
The unit is a self-cleaning oil filled and oil cooled rectangular double gap suspended magnet complete with reversible motor so that iron and iron-bearing slag can be discharged to either side of the main conveyor belt according to the user's preference.

According to Wemco, the heart of the SE Series is the exclusive space winding feature and oil cooling of the coil, which assures higher operating wattage.



Shaft Couplings (18)

T. B. WOOD'S SONS CO. "Sure-Grip" rigid coupling No. 44 will align and rigidly connect two shafts that measure up to 5 7/16 in. in dia. The shafts are clamped by the firm's interchangeable bushings, of the same type used with their V-belt sheaves and pulleys.



Shaker Screen (20)

A NEW SHAKER SCREEN that's compact yet has increased operational capacity is being introduced by Fairmont Machinery Co.

Fairmont engineers obtained desired compactness by having the drive and screen suspended from wire rope. Drive mechanism of the new shaker screen is an enclosed self-contained unit with forced lubrication and all anti-friction bearings. Units are furnished with the desired stroke and speed ranging from ½ in. at 1,000 rpm to 5 in. at 165 rpm.

For Your Files

This selected manufacturer's literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.

HANDBOOK ON THREADS, an excellent 16-page basic booklet containing thread terminology and definitions, types of threads, method of manufacture and numerous specification tables, has recently been issued by H. M. Harper Co.

This is an informative, professionally-prepared booklet—the thread-types section shows magnifications of the 10 basic thread forms, and with each are photos of the screws of which they form a part. Some of the terms appearing on the definitions page are: complete and incomplete thread, stress area, pitch, basic form of thread, lead angle, method of designating a screw thread, etc. **(83)**

THE MAGNAFLOW centrifugal pump with canned stator and flow-through type rotor-impeller is described in Corley Co.'s bulletin M-60.

The four-page bulletin tells how the pump works when mounted in any position in a pipe line, and gives complete specifications. It also includes a schematic diagram showing liquid flow through the rotor and an exploded view showing all pump parts. **(84)**

COMPONENTS AND OPERATION of the new optical leveling kit are described in Keuffel & Esser's brochure, "A New Approach to Leveling." The booklet contains full data on industrial alignment problems and solutions, including foundation or bed leveling, profiling, differential leveling and checking movement of equipment. **(85)**

"DRILLING ROCK WITH COUPLED STEELS" (bulletin 10815), detailing proper operational and maintenance procedures for coupled rock drill steels, is available from Thor Power Tool Co. The bulletin discusses and illustrates correct rotation, drill and feed control operations, starting a hole, proper feed, drilling, and lubrication practices. **(86)**

NEW CONCEPT in switchgear protection, "Fusematic," is fully described in Federal Pacific Electric Co.'s eight-page bulletin 6020.

Federal outlines why it feels "Fusematic" is superior for controlling modern electrical feeder systems in the 600 volt class. **(87)**

DUFF-NORTON CO. has outlined (with specifications) an extensive line of lifting jacks in a new four-page brochure. Some of the types discussed are: hydraulic rams and pumps, hydraulic jacks, cable reel jacks, screw jacks, air motor jacks, mine roof and timbering jacks and fittings, and governor controlled jacks. **(88)**

"TOOL STEELS," a basic guide to the use of tool die steels, is available from Climax Molybdenum Co. It was prepared by Dr. B. L. Averbach, physical metallurgy professor at MIT, and contains numerous charts, graphs and tables on the properties of the six main types of tool steel. **(89)**

VARIED FORMS, major advantages and uses of flexible tubing are brought out in "The Facts About Flexible Tubing," from Flexible Tubing Corp.

The company said that the fabric covering the coiled spring may be either cotton, fiberglass, dacron, nylon, or other materials, depending upon application. **(90)**

B-I-F INDUSTRIES has just published a new, eight-page general bulletin which provides capsule information about many of its products and systems.

The bulletin covers supervisory control systems, totalizing meters, water and waste treatment equipment and systems, flow meters, process instrumentation, feeders for solids and liquids and blenders for liquids. **(91)**

EFFICIENT, profitable mining techniques and operations are covered in a new Caterpillar Tractor eight-page, two-color booklet.

The company looks into uranium mining in Wyoming, iron and copper mining in Canada, copper waste disposal in Utah, chrome mining in Southern Rhodesia, and bauxite haul roads in Arkansas. **(92)**

NEW STEAM TRAP catalog (FE-310), illustrated in color, has been published by MIL Div., Farris Engineering Corp. MIL's catalog gives detailed information about the com-

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2	12	22	32	42	52
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pany's complete line of low cost bimetal thermostatic and float thermostatic steam traps, available in a wide variety of pressure ranges, body patterns, sizes and connections. **(93)**

FULLER CO.'s latest bulletin (F-5A) describes and illustrates its complete line of roll and vane-type feeders and rotary valves. **(94)**

TWO NEW THERMOCOUPLE bulletins—one on general components, the other on wire—have been issued by Minneapolis-Honeywell Regulator Co.

The thermocouple components release (catalog G100-3) is a 28-page specification and component-ordering guide.

Honeywell's thermocouple wire catalog (G100-2) has 12-pages of data on extension wire, bare and insulated, plus thermocouple wire itself. It also lists prices and ordering directions. **(95)**

CHARLES C. KAWIN CO., which does a wide variety of metallurgical services, has issued a brochure outlining all of the company's operations.

Kawin was established in 1903 and performs the following services: metallographic examination; chemical analysis by wet and spectrographic methods; physical testing, with shop equipment for machining of tensile and impact specimens; and analytical metrology for measuring and recording roundness and surface irregularities. **(96)**

CASE W-5 LOADER has unequalled maneuverability which cuts cycle time—insures safer operation—according to J. I. Case Co.'s latest bulletin.

The company goes on to say that its versatile 3,000 capacity loader offers: 73% more breakaway force to get heaped loads faster; better machine balance to increase traction and stability; correct power-weight ratio with choice of gasoline or diesel engine; and a series of optional equipment to increase job versatility. **(97)**

ILLUSTRATED sizes and specifications catalog (12 pages) of low-pressure, re-useable hose fittings and one and two rayon braid hose has been issued by the Lentz Co. **(98)**

COMPLETE LINE of liquid-solids separation equipment for chemical and metallurgical processing is described in a new four-page condensed catalog released by the Eimco Corp. **(99)**

NEW EDITION of the 16-page shaped wire catalog (DH-1226-A) from Page Steel & Wire Div., American Chain & Cable Co. Inc. has recently been made available.

Page says that, among other things the catalog contains helpful information on methods of calculating areas of common shapes, physical properties of steel wire, table of standard wire gages, and hardness conversion tables. **(100)**

CARBOMASTIC epoxy-tar protective coatings are explained in a new four-page bulletin (803) by the Carboline Co. of St. Louis.

An entirely new approach to coating protection is explained—approach encourages the selecting of coatings for a system that fits the individual requirements rather than using one coating for all jobs. A chart, "Commonly Used Carbomastic Systems," gives physical properties and details of components of the systems. **(62)**

TWO NEWLY DESIGNED companion slide calculators, which are very useful in a wide variety of metalworking applications, have just been issued by Adamas Carbide Corp.

By simply sliding the arrow of one of the calculators (the Carb-A-Guide) to the type of material to be machined, the operator will get machinability ratings, grade of carbide to be used, and surface speed for various ranges of feed and depth of cut. Carb-A-Guide also gives helpful hints on how to counter effects of edge wear and cratering.

The other calculator (Computor Slide) gives technical data on hardness conversion, speed conversion, milling feed rates and hp. **(72)**

NEW LINE of self-operated, pilot-operated, solenoid-operated and back pressure regulators are discussed in OPW-Jordan's eight-page catalog J-160-1. The catalog describes the applications of each of the four basic types of regulators and how each type works. The self-cleaning, self-lapping action of the sliding gate seat is clearly illustrated. J160-1 also has cutaway drawings, sizing charts, flow curves and sample specifications. **(73)**

FLEXIPIPE mine and tunnel ventilation tubing is described in a 12-page booklet by Bemis Bros. Bag Co. Some of the booklet's items are: Illustrations of the use of Flexipipe for various shaft ventilation systems; tables on flexible tubing friction loss; drawings of suspension equipment; and photographs of actual installations. **(70)**

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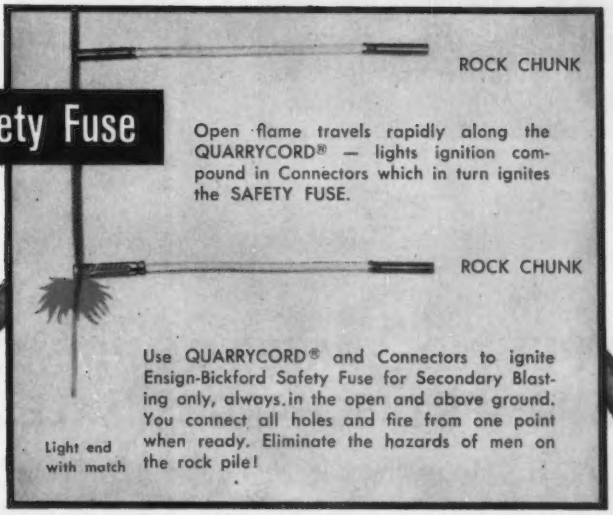
Cut Costs with Safety Fuse

Quarrycord® and Safety Fuse



Open flame travels rapidly along the QUARRYCORD® — lights ignition compound in Connectors which in turn ignites the SAFETY FUSE.

Use QUARRYCORD® and Connectors to ignite Ensign-Bickford Safety Fuse for Secondary Blasting only, always in the open and above ground. You connect all holes and fire from one point when ready. Eliminate the hazards of men on the rock pile!

Ignitacord® and Safety Fuse

Intensely hot, open flame travels at a pre-determined speed along the IGNITACORD® — lights ignition compound in Connectors which in turn ignites the SAFETY FUSE.

Use IGNITACORD® and Connectors to ignite Ensign-Bickford Safety Fuse in underground Stoping, Heading and Development Rounds. When used as directed, Ignitacord provides positive rotation firing without fuse trimming, positive initiation with one-point lighting — greater safety with economy.

Safety Fuse today – as it has over the years – offers economy, efficiency and safety. You can now use Safety Fuse in multiple-hole blasting and cut costs up to 30%

Write for this free Safety Fuse Sample Kit and folders describing Quarrycord and Ignitacord.

S-1

THE ENSIGN-BICKFORD COMPANY, Simsbury, Conn. • Since 1836

More proof that...

AMSCO HELPS YOU HANDLE MORE TONS PER DOLLAR

AMSCO PUMP OPERATES 24 HOURS A DAY...PUMPS DISCHARGE 3 MILES

AT NEW ENGLAND DREDGE & DOCK COMPANY

On the dredge C. H. Cobb, operated by New England Dredge & Dock Co., the Amsco 12" Form 50 S3B pump shown at right is "on duty" 24 hours a day, 6 days a week. It handles 5000 yards a day, pumps discharge over 3 miles with one booster... under 23 railroad tracks, through a mile-long railroad tunnel and through cliffs to a marshland.

Regarding this Amsco pump, installed 2½ years ago, Mr. C. H. Cobb, General Superintendent says—"Its performance and price make this the most desirable pump on the market".

JAW PLATES REDESIGNED IN AMSCO ALLOY...TONNAGE UPPED 75%

AT STAR ROCK PRODUCTS COMPANY

At Star Rock Products Co., Anaheim, California, crusher jaw plates previously used were giving only about 6 months' service. Large rocks dropped into the crusher often caused the jaw plates to "give" enough so the rocks wouldn't crush. Jams and costly delays resulted. Plates would often flow and crack.

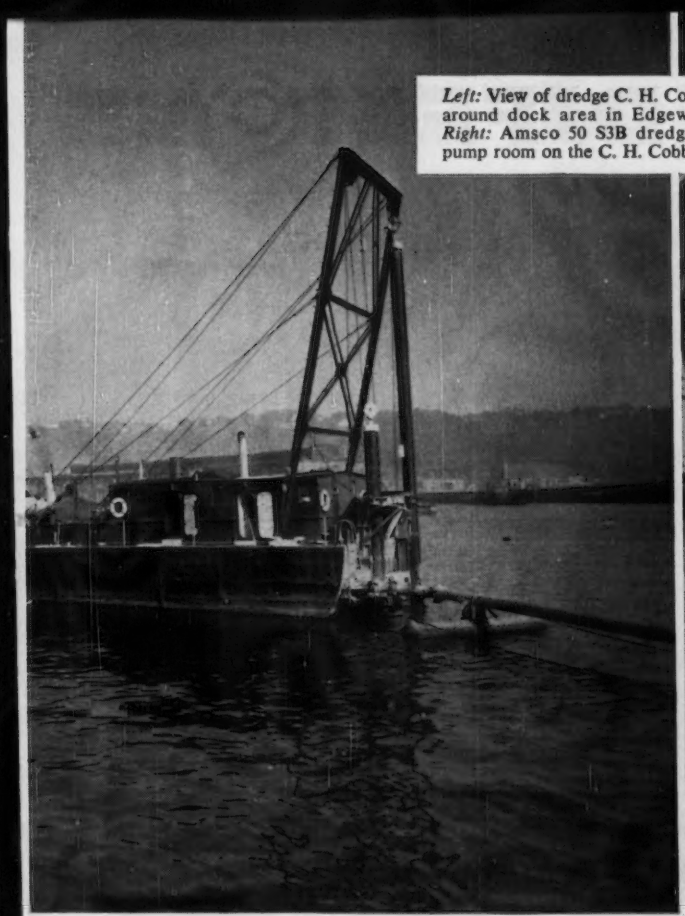
Amsco collaborated on a redesign, using 2% chrome (Amsco MY) alloy. After 6 months' service, the plates were in excellent condition. Jams and delays have been eliminated, and tonnage handled *increased 75%*.

AMSCO

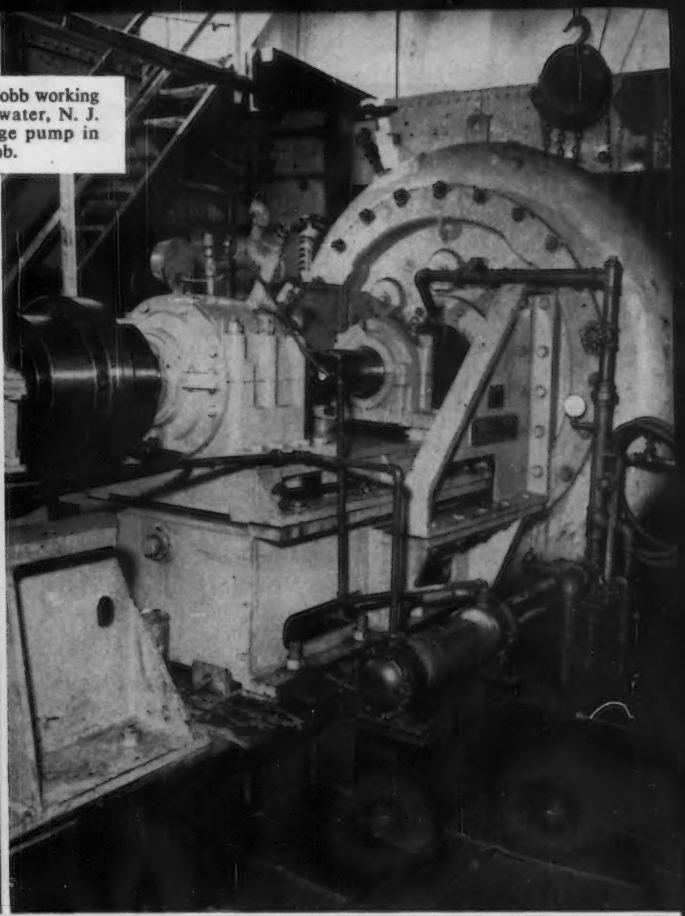
AMERICAN Brake Shoe COMPANY

American Manganese Steel Division • Chicago Heights, Ill.

Other plants in: Denver • Los Angeles • New Castle, Dela. • Oakland, California • St. Louis
In Canada: Joliette Steel and Manitoba Steel Foundry Divisions



Left: View of dredge C. H. Cobb working around dock area in Edgewater, N. J.
Right: Amsco 50 S3B dredge pump in pump room on the C. H. Cobb.



Left: General view of Star Rock Products plant at Anaheim, California.
Right: View of Straub 20 x 36 crusher at Star Rock Products. Rocks up to 18" may pass through grizzly and outer crusher.

A NEW and DIFFERENT

The first machine ever designed for YOUR hauling problems

You can tell just by *looking* at a LeTourneau-Westinghouse Haulpak® that it's quite unlike any other off-road hauler. Its bowl, for instance, has a distinctive "V" shape; its wheelbase is obviously shorter; it has none of the "hung on" tanks and cleaners so common to other haulers. Yet, these *noticeable* characteristics only *begin* to tell the story. The *fact* is that Haulpak is *completely* different from other off-road haulers!

Behind these differences are two facts: (1) Haulpak is built by a pioneer in heavy-duty *earthmoving* equipment; not by an automotive manufacturer . . . and (2) Haulpak is *designed*, from the ground up, *as an off-road hauler;* it is *not* just a beefed-up highway truck!

Haulpak differences are not "gimmicks", added on for the sake of being different. Everything you see in Haulpak has been carefully engineered with one objective in mind: to give you lower ton-mile costs on your off-road hauling.

We will be happy to arrange for a demonstration so you can personally inspect and test Haulpak. You'll see first-hand how LeTourneau-Westinghouse design and construction can pay off for you. Three sizes: 22, 27, 32 tons, up to 375 hp. Ask for complete information.

How LW Haulpak pays off for **Utah Construction & Mining Co.**

Accurate records have been kept on an LW 32 Haulpak working for Utah Construction & Mining Co., Cedar City, Utah. When these records were last tabulated, the unit had been in use 10½ months. These are the performance figures:

JOB REPORT

Scheduled hours of operation		2,681
Hours Haulpak worked		2,211
Hours lost due to Haulpak downtime		250
Hours lost for other reasons than Haulpak being down		220
Operating efficiency $\frac{2,211 + 220}{2,681}$		90.7%
Best month's operating efficiency (except one 100% month)		98.0%
Hours of overburden haul	approx.	1,665
Total bank cubic yards overburden hauled		206,164
Total loads hauled		13,744
Bank yards overburden hauled per load	average	15
Average loads per hour (conditions: 2,000 ft. one way, grades from + 8% to −8%)		8.25
Hours of iron ore haul	approx.	546
Total tons, ore hauled		80,266
Total loads of ore hauled		2,112
Tons of ore hauled per load	average	38.0
Average loads hauled per hour (conditions: 10,000 ft. one way, grades from + 5% to −5%)	average	3.87

How does <u>your</u> availability and production compare?

Hauler...built for YOU!

HP-2255-G-2

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

Where heavyweights move job records prove...
FIRESTONE TIRES KEEP BIG WHEELS TURNING!

Look to Firestone to help keep big wheels turning—to keep the cycle going and the project moving smoothly toward your finish date! That's because Firestone off-the-highway tires have built-in toughness to take rugged abuse and reduce your downtime. Shock-Fortified nylon cord, for example, guards against impact damage. And Firestone Rubber-X, the longest-wearing rubber ever used in Firestone off-the-highway tires, provides a big payoff in extra service hours. Investigate Firestone's Giant Tire Service for tires and maintenance matched to every need of every project on your docket. Call your Firestone Dealer or Store. Or write: Manager, Off-The-Highway Tires, The Firestone Tire & Rubber Co., Akron, Ohio.

ALWAYS SPECIFY FIRESTONE TIRES WHEN ORDERING NEW EQUIPMENT

Super Rock Grip Wide Base* Super Rock Grip Deep Tread*

TUBELESS OR TUBED

Firestone

BETTER RUBBER FROM START TO FINISH

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*Firestone T.M.

THIS IS MSA: Illumination · Electronic Communication and Control · Rock Dusting and Dust Collecting · Fire Fighting Equipment · Respiratory Protection · Artificial Respiration Equipment · Personal Protective Wear · First Aid Equipment · Permanent and Portable Instruments

So much depends on unfailing light

Men and machines cannot work at peak productivity without proper illumination. Poor light means unsafe working conditions. Without light there is no work, no production underground. Illumination is *that* important.

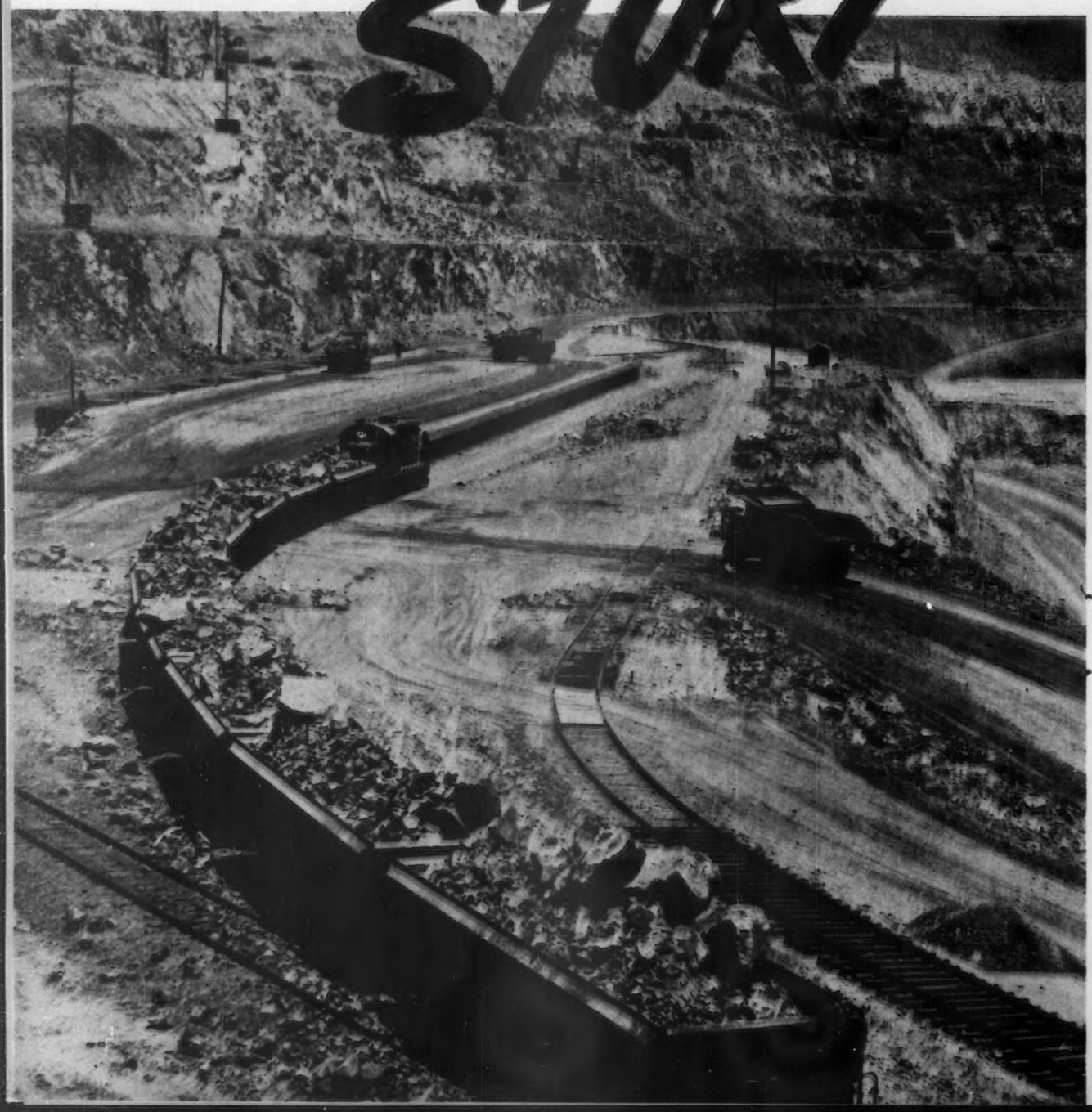
Through years of close cooperation with the mining industry, Mine Safety Appliances has developed a quality line of illumination products that put all-important unfailing light underground. And, all MSA products are backed up by a network of sales, service and warehouse facilities.

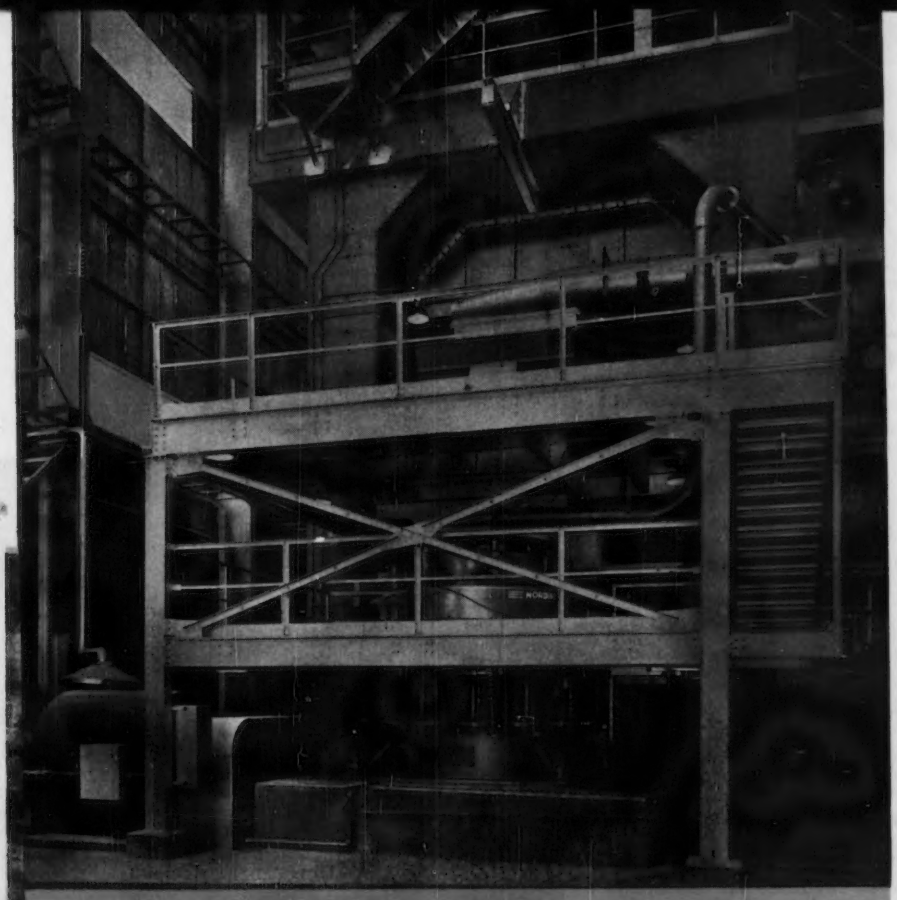
MSA illumination products include miners' Edison electric cap lamps, permissible trip lamps and fluorescent mine lighting systems. Automatic lamp charging equipment is supplied for self-service lamphouse installations.

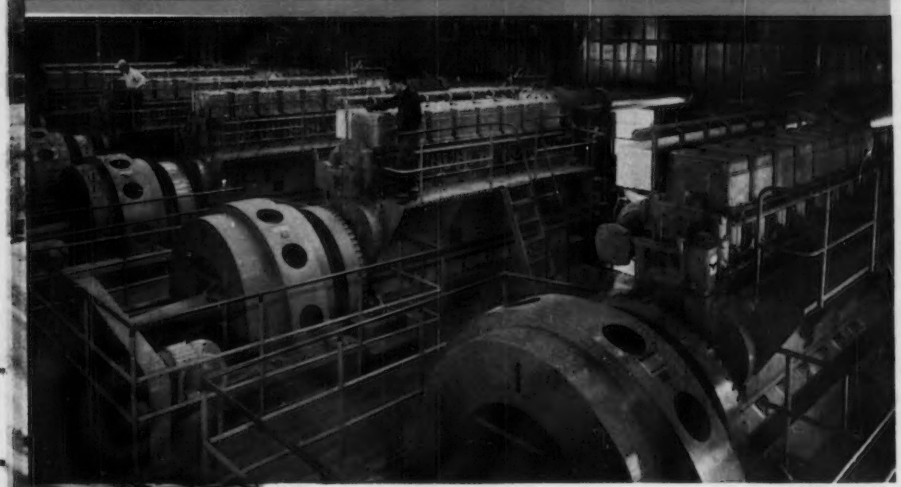
Contact your MSA representative for additional information. Or, write Mine Safety Appliances Company, 201 N. Braddock Ave., Pittsburgh 8, Pa. In Canada: Mine Safety Appliances Company of Canada Ltd., 500 MacPherson Ave., Toronto 4, Ont.

Nordberg Machinery plays important part in the

"TOQUEPALA" STORY







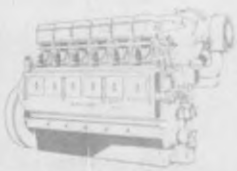
M-200 ©1960, N. M. CO.

NORDBERG TRACK EQUIPMENT

An extensive railway system serves the Toquepala mine facilities. Nordberg equipment used by the contractor in laying rail included Power Jacks, Power Wrenches, Rail Drills, and a Hydraulic Spike Puller.

SYMONS® CONE CRUSHERS

Six Symons Cones handle secondary and tertiary crushing at the big Southern Peru Copper Corp. plant. Two of these are Standard units, and four are of the Short Head type.



NORDBERG ENGINES

Five Nordberg 4-cycle diesel engine-generator units are installed at the mine, 10,600 feet above sea level. Each of the 8-cylinder Nordberg supercharged engines is rated 1830 bhp, 1295 kw at their installed altitude.

The huge Southern Peru Copper Corp. open pit copper mine at Toquepala, Peru, is one of the major new mining projects of this decade. It is now in production, after more than five years of planning and development through the combined efforts of four large metal mining companies. Each of these companies have used Nordberg Machinery in their far-flung mining operations.

For, at Toquepala, as in most of the world's great ore and mineral operations, Nordberg Mining Machinery is playing an important part in the production of large tonnages of ore at low cost per ton.

NORDBERG MACHINERY

NORDBERG MANUFACTURING COMPANY

Milwaukee 1, Wisconsin

ATLANTA® CLEVELAND® DALLAS® DULUTH® HOUSTON® KANSAS CITY® MINNEAPOLIS® NEW ORLEANS® NEW YORK
ST. LOUIS® SAN FRANCISCO® TAMPA® WASHINGTON® TORONTO® VANCOUVER® JOHANNESURG® LONDON® MEXICO, D.F.

Only REPUBLIC Mine Roof Bolts Offer These 5 CERTIFIED-PERFORMANCE

1. PRECISION-TAPERED PLUG

Expertly engineered for proper shell expansion. Angle of taper is at the precise degree required for strength, dependability, and quick efficient tightening. Whether in relatively soft formations or other types of rock strata, improved Republic Mine Roof Bolts assure best performance.

2. HEAVY-DUTY SUPPORT NUT

Square nut gives over 40% better support than even the best previous method, yet maintains correct bolt tension by stripping at approximately 50 pounds torque with no damage to bolt threads. Nut can be easily applied either side up —another plus feature.

3. MATERIAL CONTROL CERTIFICATE

Included with every shipment of Republic Roof Bolts is a certificate stating specific physical properties of the steel used. Data provided: yield point in pounds per square inch, yield and break point in pounds, and steel heat number. No guesswork about the quality you get from Republic.

MINE ROOF BOLT MATERIAL CONTROL CERTIFICATE

Republic Steel Corporation hereby certifies that the mine roof bolts included in mill order number _____ were made from the following steel:

HEAT NO.	YIELD POINT (PSI)	YIELD POINT (POUNDS)	BREAK POINT (POUNDS)

The above figures are correct as contained in the official records of the Corporation.

BY _____
UNIT METALLURGIST BOLT AND NUT DIVISION

REPUBLIC STEEL CORPORATION
General Offices • Cleveland 1, Ohio

FEATURES

4. HIGH-STRENGTH, ALL-PURPOSE EXPANSION SHELL

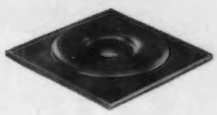
New, improved Republic RS-1 Expansion Shell is designed for effective use in any type of strata. Wide, strong leaves and flaring inside taper mean extra holding power in relatively soft formations. Narrow base supports for the leaves assure easy expansion and a wedge-like grip as the anchor is tightened.

5. IMPROVED SELF-CENTERING HEAD

Compact, one-piece head eliminates need for separate washer. The heavy flange and thick, reinforced washer are guided cleanly and firmly into position in the bolt plate. Entire unit is forged, for ruggedness and strength. Standard 1⅛" head available with ¼" and ⅝" bolt sizes.

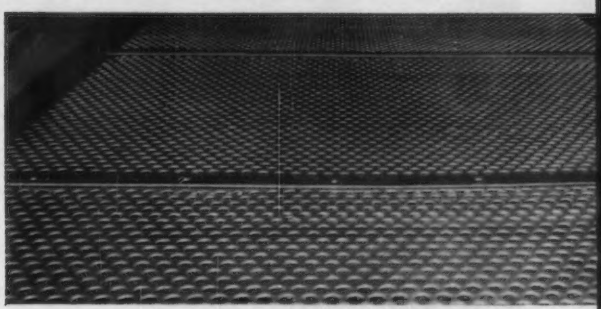
Available Pre-Assembled to Cut Your Installation Costs

You can order your Republic Certified-Performance Roof Bolts fully assembled to save you assembly costs, prevent loss of parts and damage to bolt threads. Remember to specify Republic Roof Bolt Plates, too.



REPUBLIC ELECTRUNITE® GROOVED-END TUBING offers cost-saving, time-saving advantages for many mining applications. Quickly and easily joined with Victaulic Couplings, rugged Grooved-End Tubing is ideal for air, water, drainage lines, and other heavy duty operations. Can be taken up and relaid as needs change. Send coupon for more information.

SUPERIOR STRENGTH AND CORROSION-RESISTANCE of Republic High Strength Steel are two of the reasons it's preferred for a wide range of mine industry applications. In mine and hopper car use, for example, these factors contribute to greatly reduced maintenance. Republic High Strength Steel provides excellent impact- and abrasion-resistance, too. Mail coupon.



SUPERIOR PERFORMANCE OF REPUBLIC ENDURO® STAINLESS STEEL used for this cleaning plant shaker screen has drastically reduced replacement expense. Reasons: excellent resistance to abrasion and corrosion, good strength-to-weight ratio, easy cleanability, high impact strength. Readily formed and welded, Republic Stainless Steel simplifies both manufacturing and maintenance. Mail coupon.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
DEPT. EJ-8909-A
1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send more information on:

- ☐ Mine Roof Bolts
- ☐ High Strength Steel
- ☐ Stainless Steel
- ☐ ELECTRUNITE Grooved-End Tubing

Name_____ Title_____

Company_____

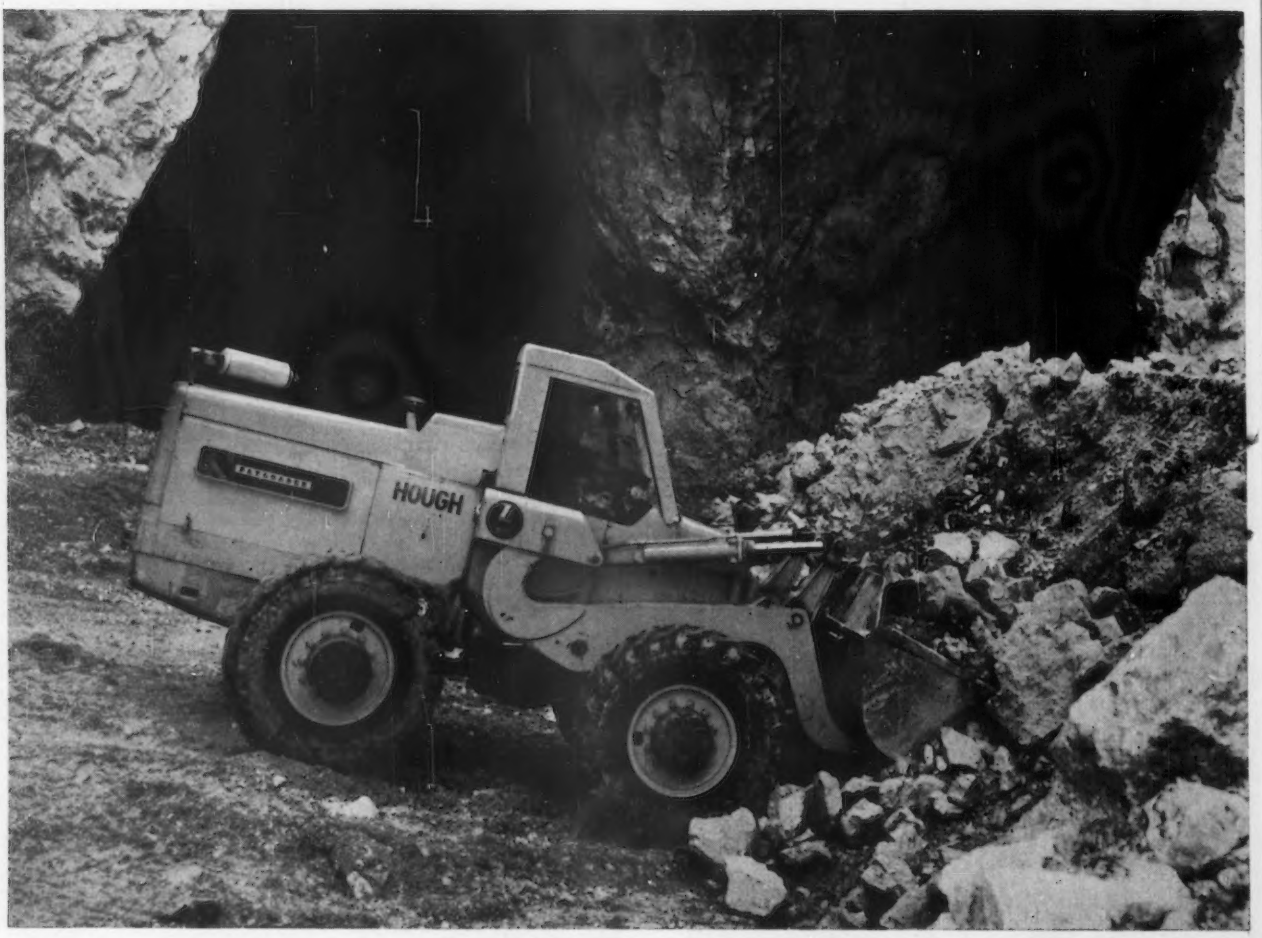
Address_____

City_____ Zone____ State_____

"The H-70 'PAYLOADER' handles with real operational ease and has the power and traction to get capacity loads under extreme work conditions," says Frank Arlen, operator.

H-70 PAYLOADER®

handles tough feldspar loading for GOLDING-KEENE CO.



Manual Underground Mine Converted to Bulk Mining

Golding-Keene Co. at Keene, New Hampshire, one of the major producers of feldspar, is engaged in an unusual mining operation. For many years its feldspar was mined underground . . . manually excavated and handled. This of course left tons of feldspar unobtainable in the tunnel pillars and supporting roof.

Recently company officials took another look at the situation and decided it was economically feasible to strip the overburden and reclaim the remaining feldspar. At one of their Cheshire County mines about 28 feet of overburden was removed, which uncovered the support pillars of the former mine, some of them ranging 250′ in depth of reclaimable material.

Key machine in their new, mechanized operation is a Model H-70 "PAYLOADER" which loads the blasted feldspar into trucks for transport to the processing plant eight miles away. Loading the huge chunks of feldspar is a tough, rugged job, but this medium size "PAYLOADER" with a 2 cu. yd. bucket, averages a 15-ton load in 7 minutes. In addition, while waiting for trucks, the "PAYLOADER" maintains the haul roads, and does general clean-up work.

There is no limit to the usefulness and versatility of "PAYLOADER" tractor-shovels . . . in all types of mining . . . strip or shaft . . . metallic or non-metallic. Their rugged strength, dependable performance, and high productive capacity make them a profitable investment for any mine. There are 20 models in 8 sizes to choose from. Send for complete details.

HOUGH, PAYLOADER, PAYMOVER, PAYLOGGER and PAY are registered trade-mark names of The Frank G. Hough Co., Libertyville, Ill.

Close, low carry position of bucket assures better balance, stability and operator visibility as well as higher travel speeds.

HOUGH®

THE FRANK G. HOUGH CO.
LIBERTYVILLE, ILLINOIS
SUBSIDIARY — INTERNATIONAL HARVESTER COMPANY

THE FRANK G. HOUGH CO.
726 Sunnyside Ave., Libertyville, Ill.

☐ Send data on Model H-70 "PAYLOADER"
☐ Send data on all "PAYLOADER" sizes

Name.....
Title.....
Company.....
Street.....
City.....State.....

4-B-5

How far will a Yieldable Set yield?

In any discussion of the Yieldable Arch or Ring, the question is invariably asked: How far will the Arch yield? Answer: It is not unusual to have a Yieldable Arch set yield until the legs almost touch each other at the center.

Gives Ground Chance to Settle

That's the whole point of the Yieldable Arch; it is *normal* for the joints to yield. It's the old technique of letting the enemy beat himself. By gradually "giving" under excessive pressures, the Arch gives the overburden a chance to settle into a natural arch of its own, and thus bring forces into equilibrium. As soon as stability is reached, the Yieldable Arch holds the line. A set of Arches consists of curved, U-shaped sections nested together and overlapped enough to permit clamping with two U-bolt clamps at each joint. The clamps control the degree of tightness, and permit yielding when the forces exceed the load for which the joint was intended. Each Yieldable Arch set is tied to adjoining sets by means of horizontal struts, which add lateral rigidity to the structure.

Usually Pays for Itself in a Year

Besides increasing mine safety, the Yieldable Arch offers high salvageability, and usually pays for itself within its first year of service. A Bethlehem engineer would like to discuss the application of the Arch to your roof problems.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

JOY HAS THE RIGHT SLUSHER FOR THE JOB

Model No.	Horsepower
S-211	5 hp
FF-211 & FF-311	7½, 10, 15 hp
A2F-211 & A2F-311	15, 20, 25 hp
B2F-211 & B2F-311	20, 25, 30, 40 hp
C2F-211A & C2F-311A	50, 60, 75 hp
R-221 & R-222	100, 125 hp
RF-211-212	100, 125 hp
XT-221 & XT-222	150 hp

With a complete line of job-rated slushers, Joy can recommend the proper unit to do the job efficiently. For true economy on the small jobs, Joy offers the S-211 and FF-211 line in sizes from 5 to 15 horsepower. These units are air or electric driven and extremely compact for portability underground.

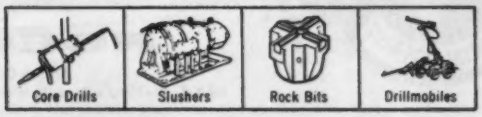
For medium capacity, Joy builds A and B class slushers from 15 to 40 hp. These two and three drum slushers are designed to handle the bulk of scraping jobs.

Three larger units in the "C" series go up to 75 hp for the heavy-duty jobs where portability is still required. For the largest semi-permanent installations, Joy builds large capacity slushers from 100 to 150 horsepower.

With more than 300 types and sizes of hoists and slushers to choose from, there is not a scraping job that can't be handled most efficiently with a Joy unit. Call in a Joy engineer for the size and type to suit your scraping jobs or write for bulletin 950-4.

EQUIPMENT FOR MINING...FOR ALL INDUSTRY

JOY



Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

When you're talking about a $162,000 dipper shovel, you've got to talk about the best rope for it

Talking about or working with, the same thing applies. Anything below Royal Blue's performance level is simply unrealistic. Like looking for a cut-price brain surgeon.

Even at $162,000, the cost of wire rope is important. That's why so-so ropes can cost you more in the long run, because so-so ropes are *short run*. Royal Blue, on the other hand, is built by America's oldest manufacturer of wire rope to last, to do the job without a whimper. Here's why.

Royal Blue is made from the toughest rope wire ever made—Type 1105—extra high-strength improved plow steel. This pedigree gives to the rope qualities that you can't find in any other rope: exceptional resistance to shock, abrasion, fatigue and impact. Add to these a flexibility that age cannot wither nor hustling fade and you've got a collection of characteristics that make Royal Blue the strongest rope you've ever used.

A $162,000 Dipper Shovel deserves the best and your Roebling Distributor has it . . . Royal Blue. Any inquiries about this high-born rope will be answered immediately by Roebling's Wire Rope Division, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities

John A. Roebling's Sons Division • The Colorado Fuel and Iron Corporation

with CYANAMID EXPLOSIVES!

The less it costs to blast and load a ton of ore . . . the more money you make. It's that simple . . . and that difficult.

Cyanamid helps you reduce your cost per ton of ore mined, with a complete line of high quality explosives, exclusively designed to give economical breakage.

Whether your ore is pure or disseminated, in thick deposits or thin veins, whatever the pitch of your vein or the nature of your ore body, there's a Cyanamid explosive that will break ore loose in a form convenient for handling.

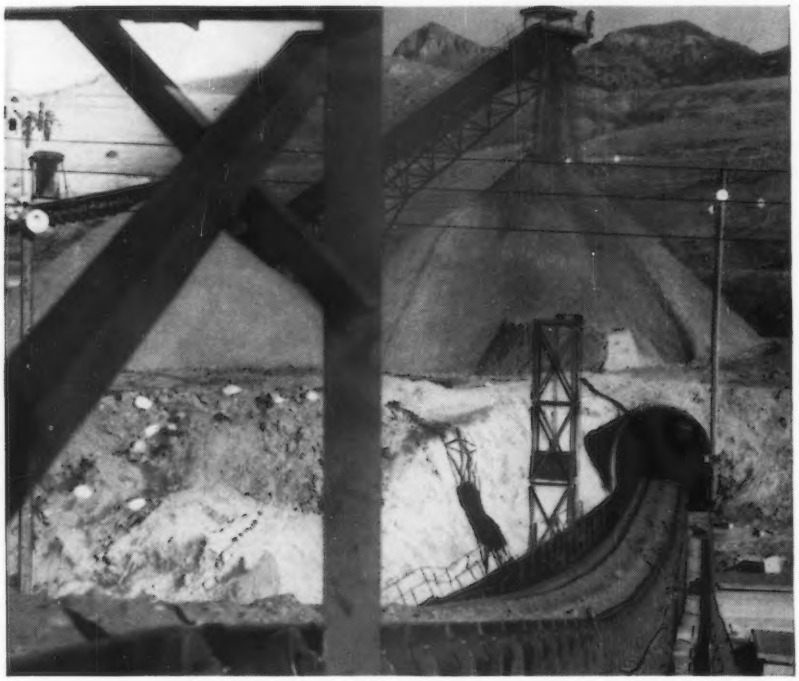
When you call on Cyanamid, you also profit from the valuable technical assistance of our experienced explosives engineers. Prompt delivery from a nation-wide network of plants and magazines keeps production moving.

For information on Cyanamid's complete line of explosives and blasting accessories, phone or write our nearest office.

CYANAMID

AMERICAN CYANAMID COMPANY
EXPLOSIVES AND MINING CHEMICALS DEPARTMENT
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

SALES OFFICES: Denver, Colorado • Maynard, Massachusetts • Kansas City, Missouri • St. Louis, Missouri • Albuquerque, New Mexic New York, N.Y. • Tulsa, Oklahoma • Latrobe, Pennsylvania • Pottsville, Pennsylvania • Dallas, Texas • Salt Lake City, Utah • Bluefield, West Virginia
PLANTS: Latrobe, Pennsylvania • New Castle, Pennsylvania • Springville, Utah
PRODUCTS: High Explosives • Permissibles • Seismograph Explosives • Blasting Agents • Blasting Caps • Electric Blasting Caps • Blasting Accessories



A portion of the 23,000-foot belt system, which conveyed gravel from a nearby mountain for the railroad causeway across Great Salt Lake. Originally designed to carry 25 million tons, it actually carried approximately 60 million. Thirteen co-ordinated conveyor lines sped more than 75,000 tons of gravel per day through a 400-foot drop in two miles, at 850 feet a minute.

HOW NEOPRENE BELTING HELPED MOVE A MOUNTAIN

To help keep the world's highest capacity belt conveyor system running at top efficiency during construction of the 13-mile Great Salt Lake causeway, engineers specified grease and abrasion resistant Du Pont neoprene for the bottom covers of all belts.

NEOPRENE UNAFFECTED BY ACCIDENTAL GREASE DRIPPAGE

The conveyor lines were designed with return sides of the belt unprotected by decking. Therefore, neoprene bottom covers were the operators' guarantee against the possibility of accidental grease damage. There was no grease deterioration to these neoprene covers.

NEOPRENE WITHSTANDS HEAT BUILD-UP AND ABRASION

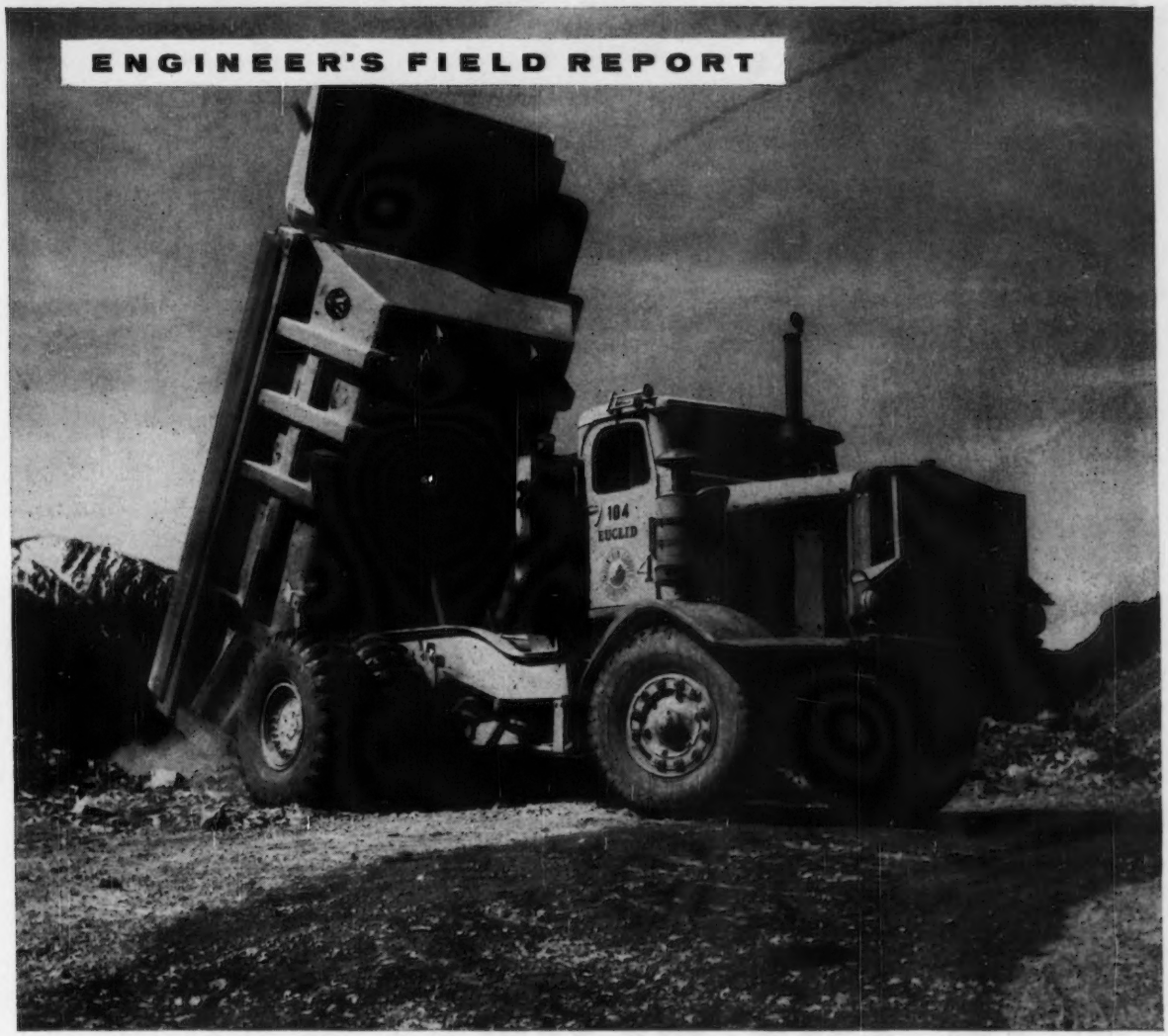
Rugged Du Pont neoprene resisted frictional heat and abnormal abrasion produced by moving heavy loads over drive and idler pulleys at twice the speed of conventional belt conveyors.

This is one of the many applications proving that you can depend on versatile Du Pont neoprene to handle the toughest jobs. Neoprene belting not only resists grease, but also heat, abrasion, oil, sunlight, weather, ozone and natural aging. It also is well known for its excellent flame resistance. This unique combination of properties gives you true economy through longer belt service. For information, write E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Dept. EMJ-8, Wilmington 98, Delaware.

DU PONT
REG. U. S. PAT. OFF

NEOPRENE
SYNTHETIC RUBBER

Better Things for Better Living . . . *through Chemistry*



25-ton payloads . . . yet off-highway trucks average 4 to 6,000 hours before overhaul

For the past four years, six Euclid 36 TD dump trucks have played a key part in Mountain Copper Co. of California's open-pit mining operations near Redding. Using RPM DELO Supercharged #3 Oil, this fleet has already worked more than 40,000 hours without a lubricant failure.

Operating conditions are tough for the "Eucs"; put a real strain on their engines. Hauling iron pyrite ore to the crusher plant and removing waste (above), they must travel loaded down 7% grades. Payloads range up to 25 tons . . . dust is thick . . . and temperatures reach 105° for six months of the year. Despite all this, the trucks work from 4,000 to 6,000 hours before engine overhaul.

"We have no wear problems at all using RPM DELO Supercharged #3," says Master Mechanic Ben Jacklin. "Never had any lubrication trouble in any engine using it. The oil's done an outstanding job in our equipment."

RPM DELO Oils reduce wear and prolong engine life because they cling to parts whether the engine is running or idle. Anti-oxidant fights gum and lacquer formation, special detergent keeps parts clean. Other additives prevent corrosion, crankcase foaming.

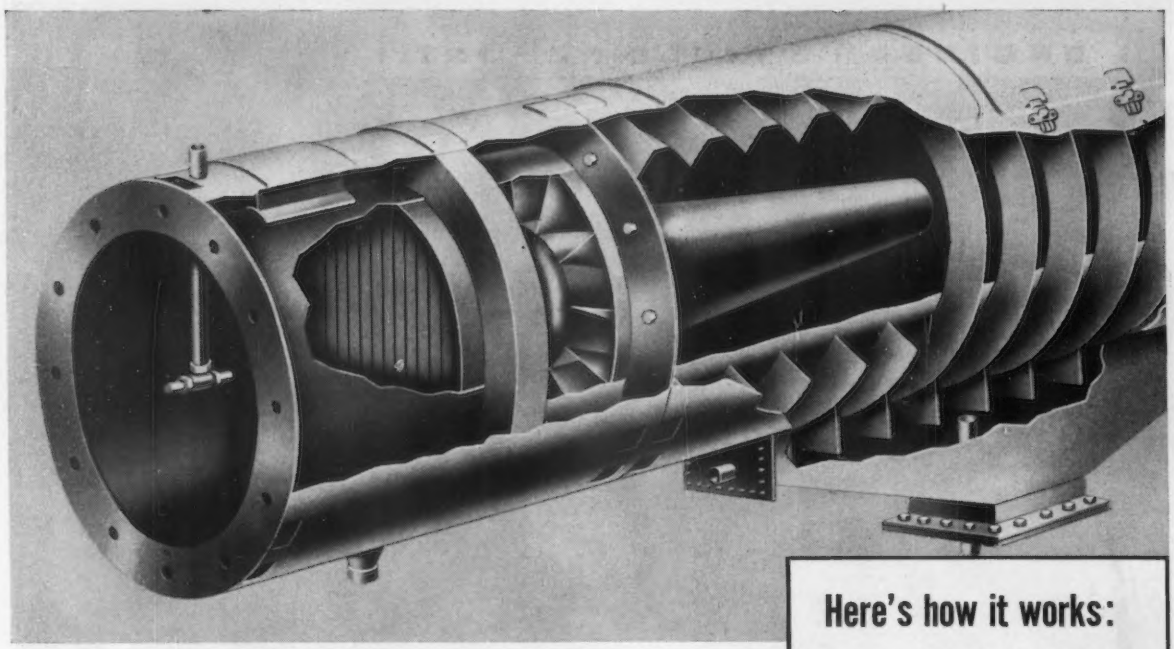
Why not try RPM DELO Oils? Let them cut your costs, lengthen equipment life. Just call your local representative, or write any company listed below:

LUBRICATING OILS RPM DELO

STANDARD OIL COMPANY OF CALIFORNIA, San Francisco 20 **STANDARD OIL COMPANY OF TEXAS,** El Paso

THE CALIFORNIA COMPANY, Denver, Colorado

TRADEMARKS "RPM DELO" AND CHEVRON DESIGN REG. U.S. PAT. OFF.



The Western Precipitation

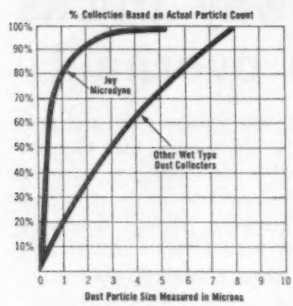
JOY MICRODYNE®

SCRUBBER PACKS HIGH EFFICIENCY IN 1/10 THE SPACE

Here's how it works:

a spray of liquid enters the collector along with the dust. An impingement screen helps to encase each particle with liquid. Then fixed vanes impart a whirling motion to the wet, dust laden air. Moisture and dust particles are thrown to the sides by centrifugal force and drain into a sump.

The liquid used may be water, oil or solvents, depending on the material being collected.



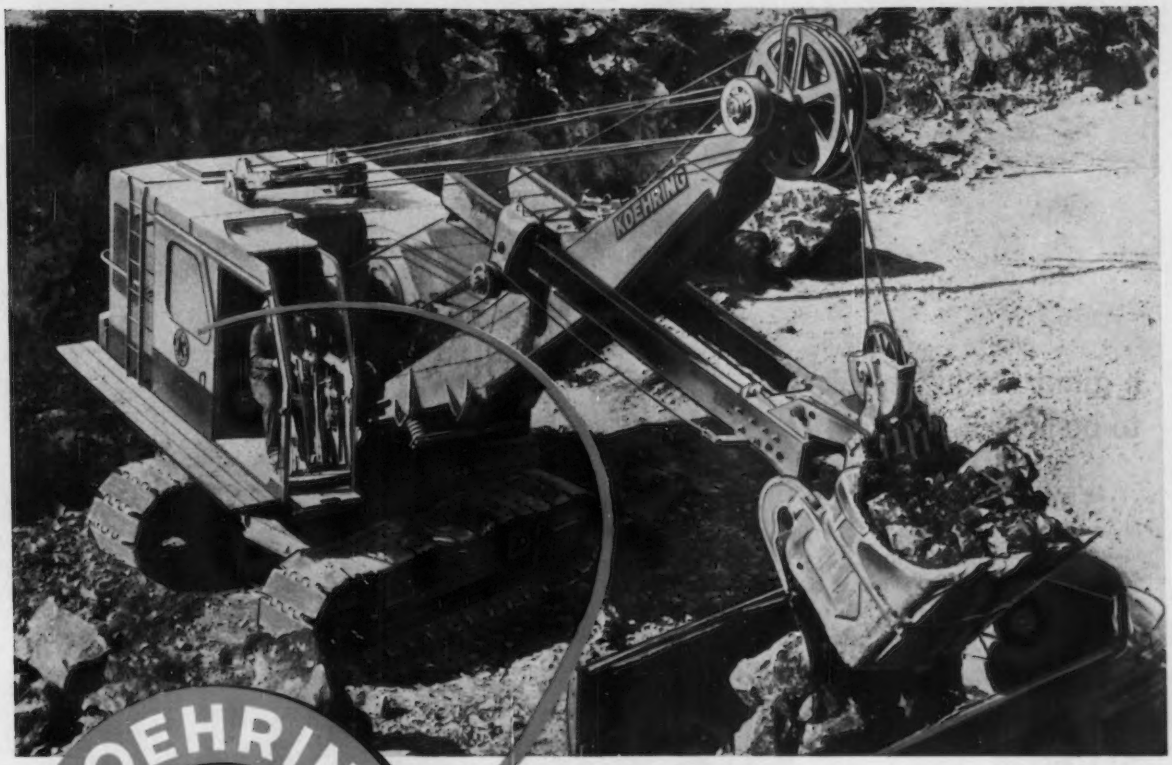
By combining two proved principles of dust collection, the Joy Microdyne collects over 99% by weight of dust particles 5 microns and larger; 92% of 2-micron dust. This means cleaner air.

Because of its unique design the Joy Microdyne is extremely compact . . . 1/10 to 1/20 the size of conventional wet collectors. For example: an 8000 cfm unit is only 26″ in diameter, 130″ long. This means lower initial cost and easier installation . . . in fact, the Joy Microdyne can be installed as part of existing ductwork.

The Joy Microdyne Scrubber is another in the wide range of dust collection equipment offered by Western Precipitation—by far the most complete line in the industry. *Write for descriptive literature!*

WESTERN PRECIPITATION
DIVISION OF JOY MANUFACTURING COMPANY
1000 WEST 9TH STREET, LOS ANGELES 54, CALIFORNIA
NEW YORK 17 • CHICAGO 2 • PITTSBURGH 2 • ATLANTA 5 • SAN FRANCISCO 4
IN CANADA: 8582 MOUNTAIN SIGHTS AVENUE, MONTREAL, P. Q.

Cottrell Precipitators	Multiclone Dust Collectors	Therm-O-Flex Hi-Temp Filters	Dualaire Reverse-Jet Filters	Turbulaire-Doyle Scrubbers	Joy Microdyne Scrubbers	Combination Units	Holo-Flite Processors	Hi-Turbiant Heaters



KOEHRING HEAVY DUTY

KOEHRING *MEANS* HEAVY DUTY

The words "HEAVY DUTY" are an important part of the Koehring trademark . . . have been for years. And there's a mighty good reason: Koehring excavators have proved through millions of hours of service that you can count on them to outproduce and outlast other makes even under the most severe digging conditions. They're *heavy duty* through and through.

Take the front end, for instance. The big tough rock boom, double dipper sticks, rugged chain crowd, and long wearing dipper give you real *heavy duty* dependability at the business end. Or take the crawlers. Each individual shoe actually is strong enough to support the *entire machine,* plus its rated load. Or take the main machinery. Shafts are kept in perfect alignment because side stands are line bored in place as a unit.

Yes, Koehring *means* Heavy Duty. That's why you can *expect* more from a Koehring excavator . . . why you *get* more from a Koehring.

K18

See your distributor about the Koehring Equipment Show Waukesha, Wisconsin Week of September 19

MORE WORK CAPACITY...

MORE PROFIT PER DOLLAR INVESTED

KOEHRING

DIVISION OF KOEHRING COMPANY

Milwaukee 16, Wisconsin

a giant needn't speak to be heard...

. . . he need only be a giant.

he need only do the things
that only a giant can do . . .
and he will be listened to.

we have a giant of our own.
his name is diesel.
he is an engine—
a supplier and creator of power.
his jobs are many and varied,
his demands are infrequent and few.

in an emergency
he can work on almost any fuel.
on assignment
he can work almost anywhere at all.

he makes the boats go . . .
towboats on the Mississippi,
harbor boats in Pakistan,
fishing fleets out of Portugal,
tuna clippers off Peru.
in wartime he drove submarines
and landing craft.
today he helps atomic vessels
do their job.

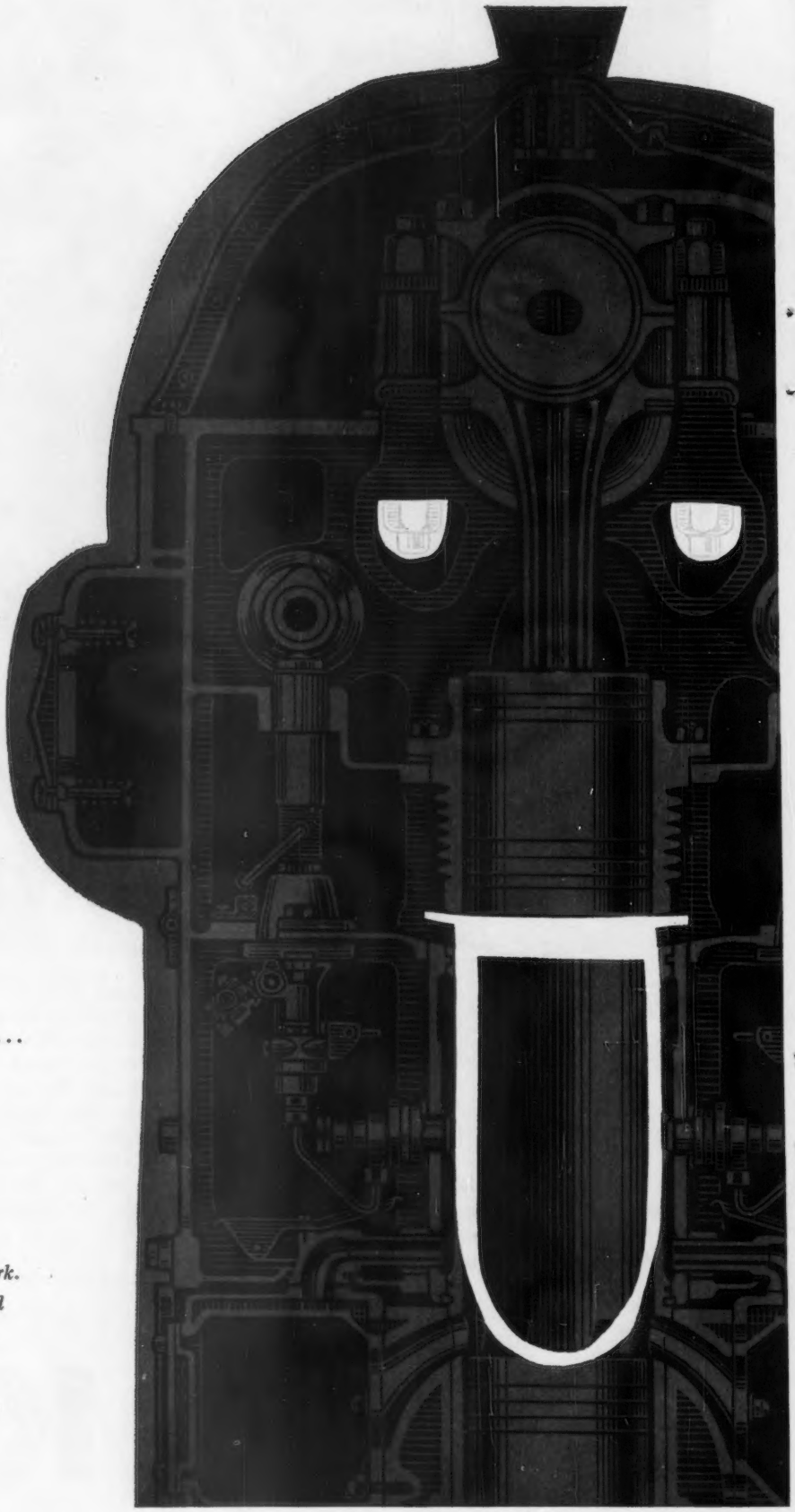
he drives . . .
cement mills in Indonesia,
dredges in Manila Bay,
oil drills in Venezuela,
rigs in the Gulf of Mexico.
he pulls buses, trucks and tractors . . .
locomotives, rock-crushers
and bulldozers.

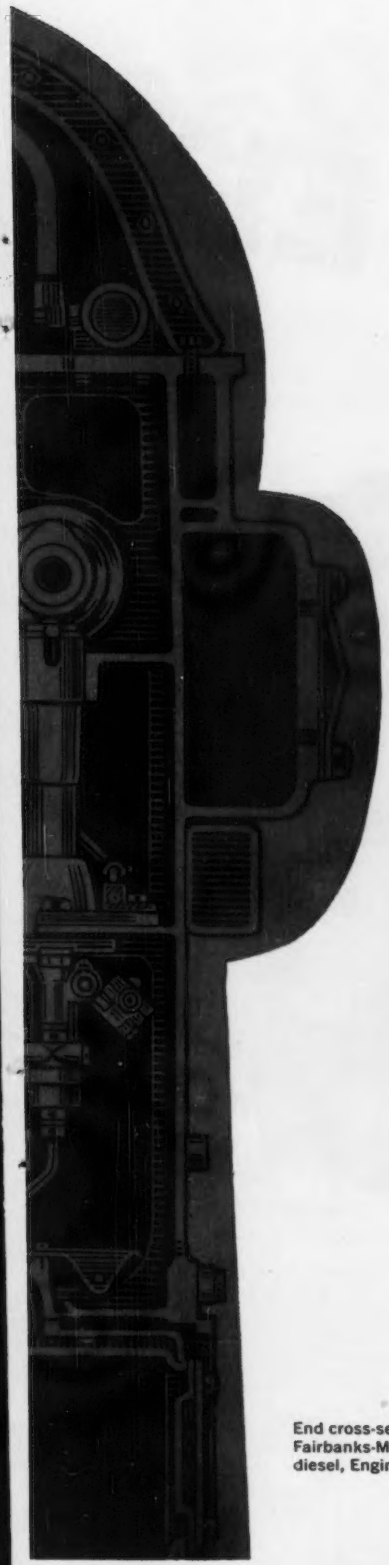
he generates . . .
light for cities
and power for plants,
electricity for homes
and more for hospitals.
he powers
missile stations in Wyoming,
radio stations in Sudan
and emergency stations in New York.

there is no country in the free world
where he is a stranger.

there is nothing he will not tackle
and little he cannot do.

his voice is in his accomplishments
and you hear it every day.





End cross-section of the
Fairbanks-Morse Opposed-Piston
diesel, Engine No. 38D8-1/8

From Beloit to Bangkok—Fairbanks-Morse diesels are known, respected and relied on. They can be tailored to available fuel. They handle heavy loads in short periods of time. And they provide low-cost electricity for almost every situation you can think of. Their minimum weight, lack of vibration and simplicity of construction are further guaranteed by our 24-hour service the world over. There is no other producer of power more universally accepted than our diesel.

If your business demands effective, dependable and economical power—you will be interested in learning more about our complete line of diesel engines.

Write to: Diesel Division, Fairbanks, Morse & Co., Beloit, Wisconsin.

Fairbanks, Morse

A MAJOR INDUSTRIAL COMPONENT OF **FAIRBANKS WHITNEY CORPORATION**

Reporting more news from...

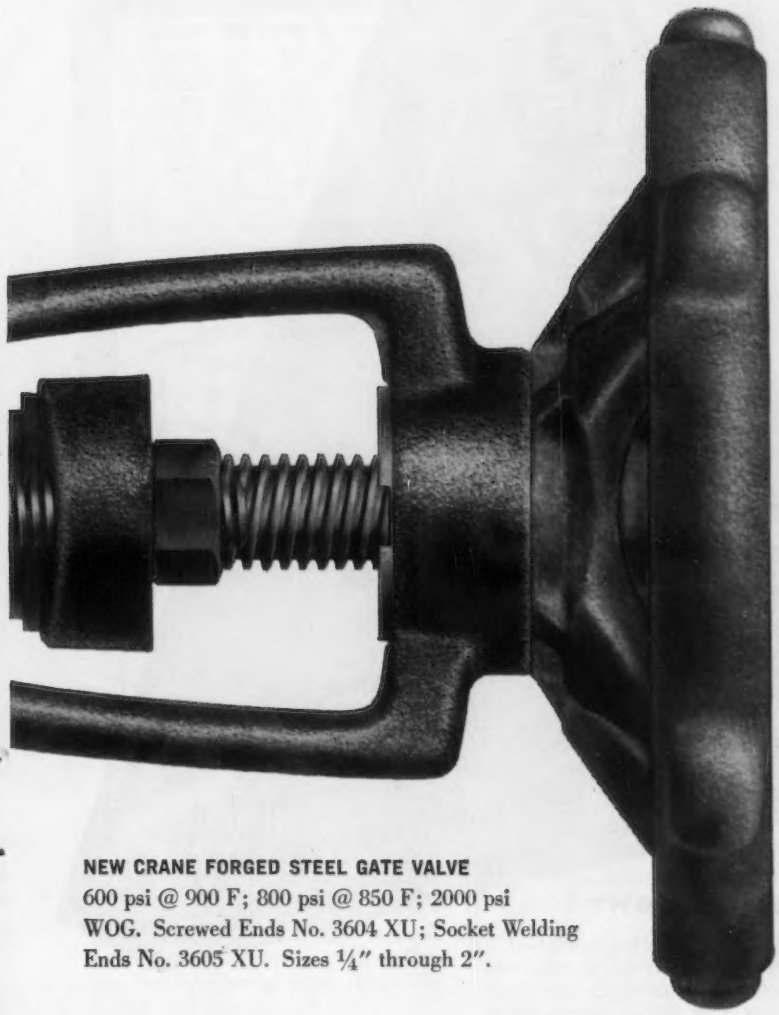
CRANE DIRECTION'70

...a fast-moving program of planned expansion, product development, and streamlined distribution to help our customers meet the competitive challenges of the Sixties.

COMPLETELY

REDESIGNED!

THE NEW SMALL FORGED STEEL GATE VALVE



NEW CRANE FORGED STEEL GATE VALVE
600 psi @ 900 F; 800 psi @ 850 F; 2000 psi WOG. Screwed Ends No. 3604 XU; Socket Welding Ends No. 3605 XU. Sizes ¼" through 2".

This is a whole new valve, not just one with a new feature added. This redesign incorporates all the features you told us you wanted plus a few others we know will make this valve a better buy in terms of longer service life, less maintenance, easier and faster servicing.

Like the new "bow-leg" yoke, which for the first time gives you plenty of hand room for easy stuffing box maintenance. And like the long-life braided asbestos packing, with Inconel wire insert. The "universal" trim that can be used for either oil or steam, eliminating many of your stocking problems. The spiral wound stainless steel bonnet gasket with asbestos filler, made blowout-proof with a male-female joint.

But what we really want you to remember, more than any single feature, is that this Crane valve is the newest—all new—valve on the market . . . well worth considering when you need small, high-pressure steel gate valves. We'd like you to compare this new valve with any other comparable valve feature for feature.

Your local Crane distributor has technical literature and a complete selection of these valves right in stock. Call him on small steel gates. In fact, he's your best bet to call no matter what valve you want because he carries the broadest line of quality valves in the world.

CRANE®

CRANE CO., INDUSTRIAL PRODUCTS GROUP
4100 S. KEDZIE AVE. • CHICAGO 32, ILL.
VALVES • ELECTRONIC CONTROLS • PIPING
PLUMBING • HEATING • AIR CONDITIONING

For those hard, tough jobs . . . try

CHROME MOLY or MANGANESE STEEL CASTINGS

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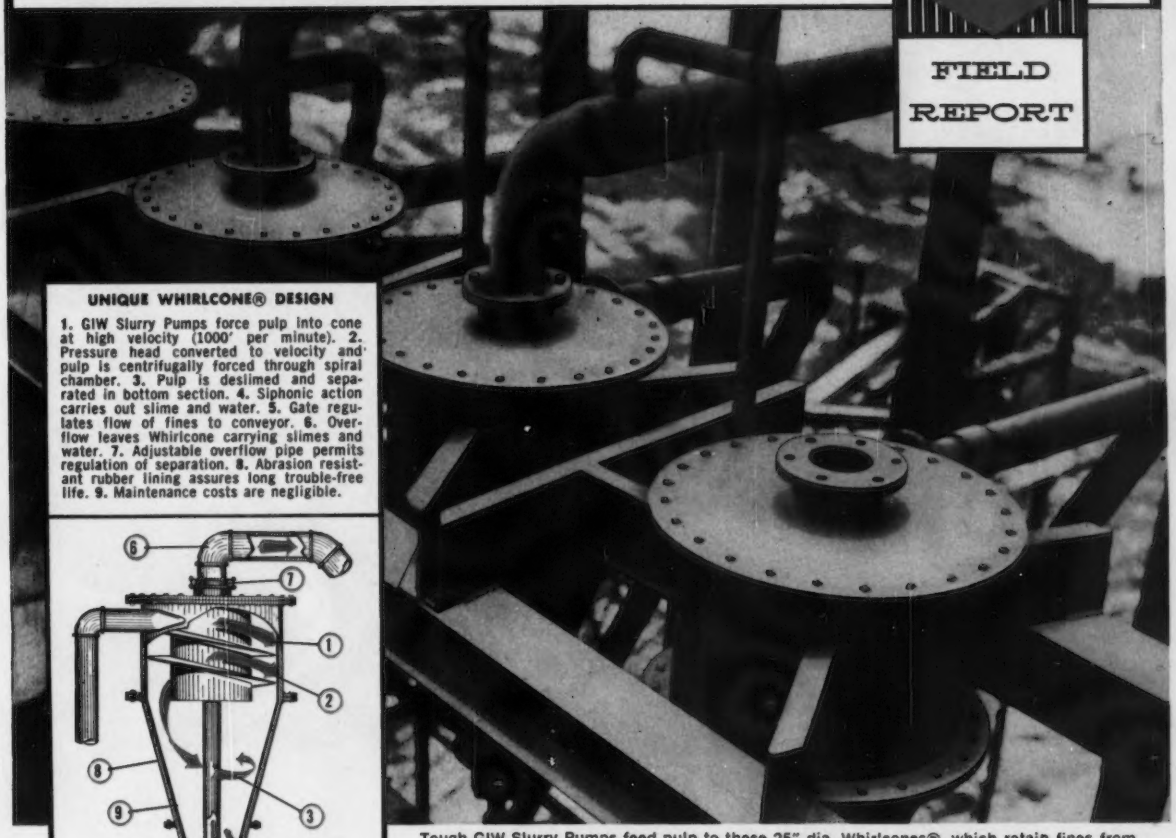
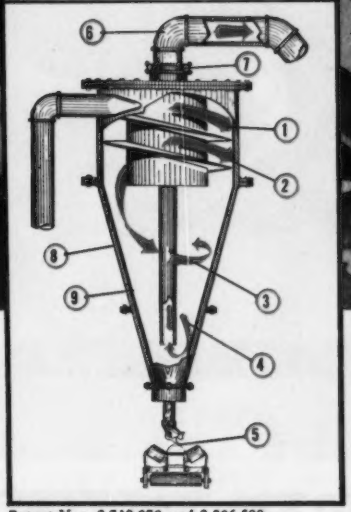
GIW

FIELD REPORT



UNIQUE WHIRLCONE® DESIGN

1. GIW Slurry Pumps force pulp into cone at high velocity (1000′ per minute). 2. Pressure head converted to velocity and pulp is centrifugally forced through spiral chamber. 3. Pulp is deslimed and separated in bottom section. 4. Siphonic action carries out slime and water. 5. Gate regulates flow of fines to conveyor. 6. Overflow leaves Whirlcone carrying slimes and water. 7. Adjustable overflow pipe permits regulation of separation. 8. Abrasion resistant rubber lining assures long trouble-free life. 9. Maintenance costs are negligible.



Patent Nos. 2,738,070 and 2,806,599

Tough GIW Slurry Pumps feed pulp to these 25" dia. Whirlcones®, which retain fines from classifier overflow. Maximum recovery rate is 20 tons per hour per cyclone. The cones will handle material from −12 mesh to lightest slime.

Whirlcone® Separators solve difficult fine recovery problems.

The retention of fines in the −50 plus 200 mesh range posed a disturbing problem for the Becker County Sand & Gravel Co., of Cheraw, S.C., primarily because the large amount of water used in processing the sand and gravel washed out the desirable fines with the minus 200 slimes.

Fourteen 25" dia. Whirlcone® wet type cyclones installed parallel in four Becker plants solved this problem completely. Operating an average of 8 hours daily, they extract up to 100 tons of clean, fine sand per hour from wash water while the minus 200 mesh slime is discarded.

Recovered fines are used to bring sand up to specifications. Thousands of tons of valuable sand, formerly lost, soon paid for the low cost of the Whirlcones®.

GIW's highly efficient Whirlcones® are also being used in the mining fields to deslime, degrit, classify, concentrate, make dam and mine backfill and to dewater or thicken where the overflow can be returned to the process or it can be discarded.

They are available in diameters from 6" to 50". Capital cost including the pump is 20 to 50% of conventional classifiers.

If you are losing fines from material −12 mesh to lightest slimes, write today. Recommendations and literature will be forwarded promptly.

COTTRELL ENGINEERING
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Manufacturers of pumps, dredges, separators and accessories.

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It's simple for a tractor loader operator to work faster—get more done. It's just as easy for him to go into a high gear as into a low gear—forward or reverse. ONE LEVER controls both speed and direction. No fumbling around with two or more levers or a combination of levers and foot pedals.

Besides operating simplicity, a tractor loader has *firmly connected axles*—attached to frame with 2-inch diameter steel pins . . . no rolling and shifting under load. *Extra stability* lets operators get and deliver

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bigger loads with greater comfort. Add *extra reach* for fast, even dumping and you can see why production is higher with an Allis-Chalmers tractor loader. Let your dealer show you. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

The "Big Three" tractor loaders range in size from the TL-14 with 5,300-lb carry capacity to the TL-20 (shown) with 9,000-lb carry. Each has a family of buckets—18 bucket loader combinations in all.

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CONVEYOR SYSTEMS 1600 MI. APART SPEED ORE SHIPMENTS TO U.S.

Specially designed Barber-Greene system utilizing unique hinged arch-type supports mechanizes shipping terminal for U.S. Steel subsidiary

Two Barber-Greene conveyor systems, located 1600 miles apart in South America, help speed manganese ore from a Brazilian mine to a shipping terminal in Uruguay where the ore is loaded into ships for delivery to U.S. steel mills.

The shipping terminal is operated by Compania Navigen Sucursal Uruguaya, a U.S. Steel subsidiary, and began operation in 1958.

Navigen Company officials say, "The Barber-Greene conveyor equipment at the Transfer Station has operated very satisfactorily and was well chosen." Navigen's Technical Director at Nueva Palmyra during installation reports: "Barber-Greene factory assembled terminals were a great help in erection, particularly due to the scarcity of skilled labor. And we got needed technical and engineering support from Barber-Greene personnel from initial planning through erection and operational stages."

Three conveyors at mine

The mine installation at Corumba, Brazil, operated under contract with another U.S. Steel subsidiary, consists of two tunnel conveyors plus a third barge loading boom conveyor that extends out over the river and is adjustable to river levels and barge heights.

At the shipping terminal at Nueva Palmyra, Uruguay, six Barber-Greene conveyors totalling 2,655′ unload barges, stockpile the ore and reclaim it for loading into ocean-going vessels. Stockpiling capacity totals 75,000 tons.

Design features

Unique design features: Giant hurricane-proof cantilevered supports that are clear of the stockpile and under which the stockpiling conveyor is hung; reversible belt on the longest conveyor in the system which permits use of the same conveyor for both stockpiling and reclamation operations; run-around system that allows ore to be moved directly from barges to ships when stockpiling is not necessary; and a cantilevered ship loading shuttle conveyor that can be positioned to handle ships of various widths.

The same engineering skill that designed this heavy-duty system to handle 156 lbs./cu. ft. manganese ore is ready to work for you, or your engineering firm. Your Barber-Greene conveyor specialist will gladly explain how standardized or specially engineered systems, or a combination of both, can bring increased efficiency, dependability and lower costs to your material handling problem.

View of inclined conveyor used to reclaim ore from stockpile at Nueva Palmyra. All belts in system are 30″ wide and run at average 350 fpm speed. Some of the nearly 1,000 Barber-Greene heavy-duty roller-bearing idlers with 6″ diameter rolls are visible here.

Ore from 75,000 ton stockpile is reclaimed by 515' tunnel conveyor fed by 33 gates. Material moves up inclined conveyor, over 854' reversing conveyor and passes over shuttle conveyor enroute to ore boats.

Overall view of terminal shows how whirly crane used to unload barges, hopper, 42" x 10' Barber-Greene belt feeder and tail end of first inclined conveyor are all located hundreds of feet offshore on a cellular dock.

Upper view of 746' stockpiling conveyor at Nueva Palmyra shows top cantiliver supports that resist winds up to 130 mph. Conveyor has traveling tripper that discharges incoming ore onto stockpile.

Send for New Idler Bulletin

New 44-page Idler Bulletin describes the more than 800 units available in the complete Barber-Greene line, tells how their years-ahead features bring longer life and greater economy to every job. Ask for your copy today.

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Timken® bits speed chip clearance, cut drilling costs

You can clear chips faster, save time and money, with Timken® carbide insert bits. One big reason is the 5 front hole design, pioneered by the Timken Company. It shoots air or water directly against the rock face; and the wider wing clearance works to clear chips extra fast. You get more hole-per-bit because you drill rock—not chips.

You save more because the special analysis carbides have extra resistance to shock and wear, can be reconditioned many times. And the bit bodies are made of Timken fine alloy steels.

Another reason why more people use Timken bits than any other removable rock bit is the service they get from Timken Company field engineers—the kind of service you can't get anywhere else. For more hole-per-bit on drifters, sinkers and stopers, use Timken bits. They're available in a complete range of bit sizes and types. Get the full details in a free brochure. The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable: "TIMROSCO". *Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.*

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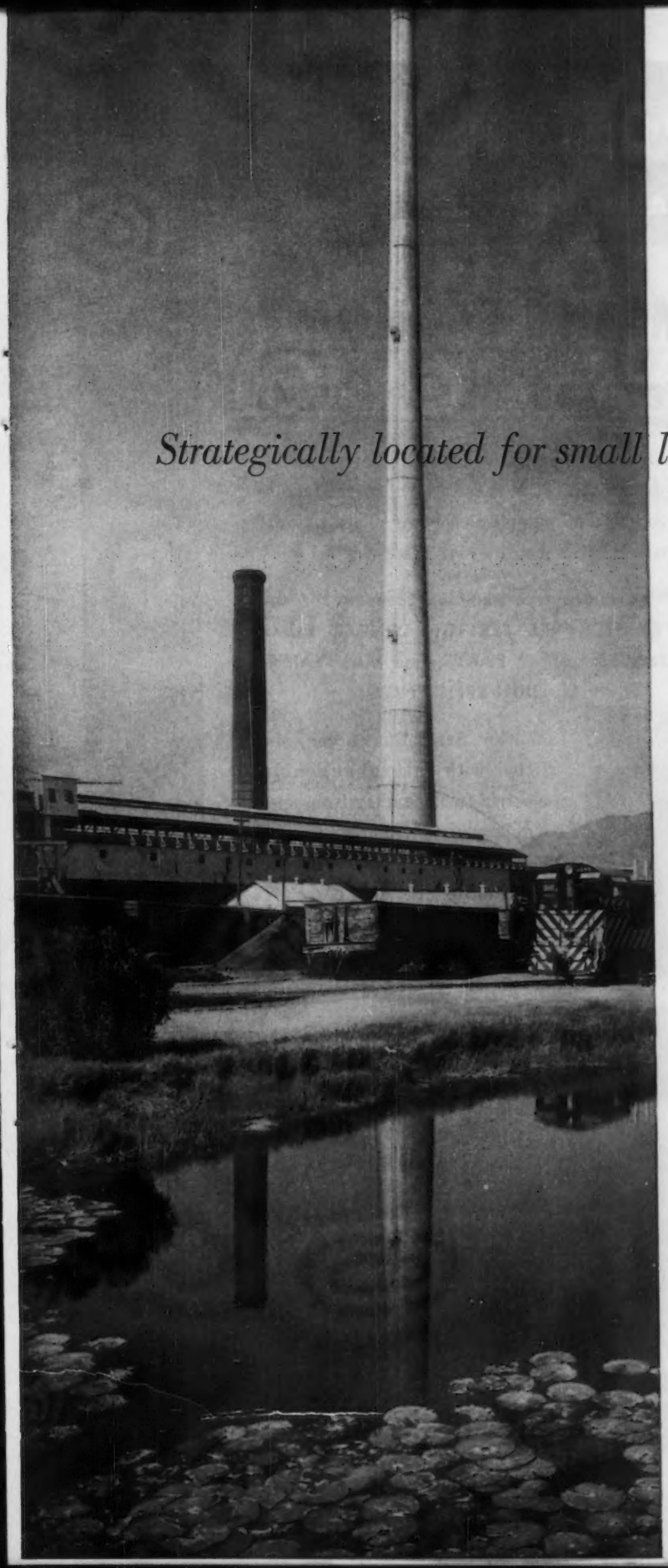
Timken tapered socket carbide insert bit, the "TTC", is removable for full steel life, tapered for more secure union. Has same frontal features as threaded bit. Gives you bit removability with one-piece strength.

TIMKEN®
removable rock bits



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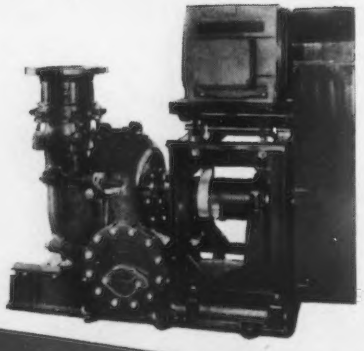

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ENGINEERING AND MINING JOURNAL

AUGUST 1960

Will There Be a Beryllium Boom?

WITHOUT DISCREDITING the growing need for beryllium metal and beryllium oxide and compounds in spacecraft, aircraft, automobiles, electronics and electrical and plastic manufacturing, demand in these fields does not appear to be of such proportion as to warrant a frantic search for beryl or other beryllium minerals. We are basing this conclusion upon the obvious fact that if the Government needed beryllium excessively at this time, these needs would have become evident through the Pentagon, Atomic Energy Commission, U. S. Bureau of Mines, stockpiling agencies or the Office of Mineral Exploration. Actually because of our anemic beryllium resources, excessive dependence upon imports, and the steadily growing demand for beryllium metal and compounds, there is much solid basis for the expansion in production by leading beryllium companies, the diversification of mining companies into the beryllium field, and the accelerated search for beryllium mineral reserves now under way. But don't expect another boom akin to that spurred by the needs for uranium—at least not on the basis of present or near-by requirements. E&MJ will evaluate the beryllium situation in an article in the September issue.

No Market—No Mine

"YOU DON'T HAVE A MINE unless you have a market!" Recognition of this principle has nudged copper, lead and zinc producers to accelerate research and promote market development more extensively in recent years.

The same principle applies to nonmetallic minerals. A case in point is the agreement negotiated recently by Premier Joseph R. Smallwood's administration in Newfoundland and the Flintkote Co. under which extensive gypsum deposits near Flay Bay, Nfld., will be developed. (See p 124.) Here gypsum deposits exceeding some 200-million tons will find an outlet to markets on the St. Lawrence Seaway, and Atlantic and Gulf sea-boards, through an aggressive plant expansion and market development program by Flintkote which will cost more than $20-million. Success of the new project depends upon heavy capital investments in plant and market development to provide an outlet for gypsum, extensive deposits that will keep the processing plants busy for many decades, and an equitable working agreement concluded between the Government of Newfoundland and the Flintkote Co.

Progress Report on the Portable Pension Plan

LETTERS FROM READERS have been predominantly in favor of some sort of a portable pension plan for mining engineers as outlined in our editorial of May 1960, p. 85. (See letters p 178.) Mining engineers quizzed by the editors on this subject have also expressed positive favorable opinions on a portable plan. Views expressed have nearly always taken this line—mining engineers, by the very nature of their profession, may be forced to move about from one company or project to another during their careers—hence it's only logical that they retain some sort of equity toward retirement in the various pension set-asides that have accrued as the result of service with various companies.

But the volume of replies has been disappointingly small. Therefore, we urge readers who have opinions on the proposed portable pension plan, either for or against it, to send their comments to ENGINEERING & MINING JOURNAL, 330 W. 42 St., New York 36, N. Y.

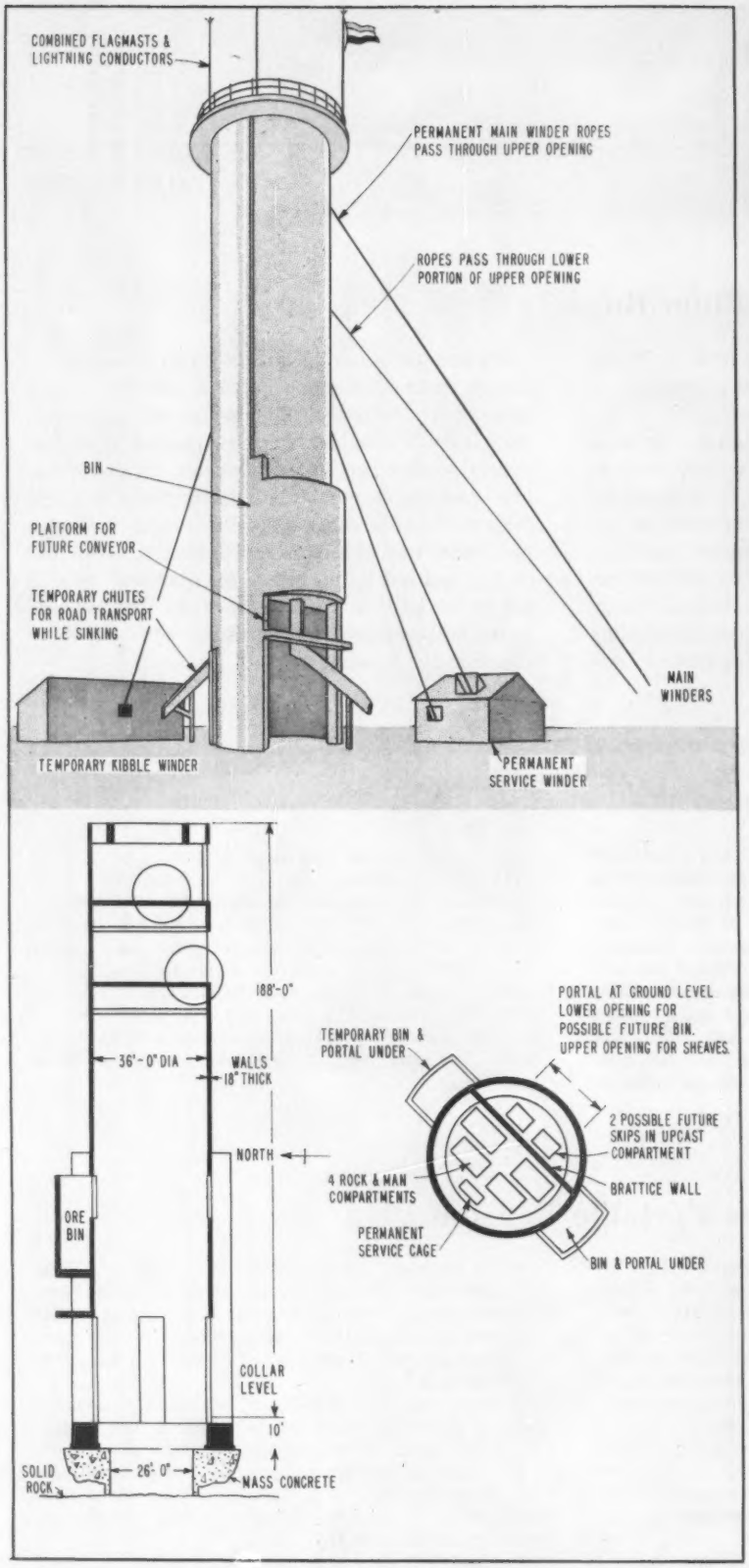
If response to this appeal confirms the favorable views already expressed on the portable pension plan, E&MJ will lend its full editorial support toward:

1. Seeking the cooperation of mining companies in establishing a plan.

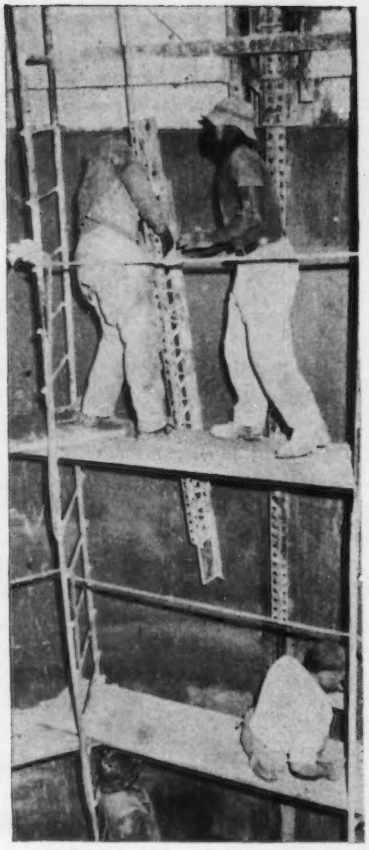
2. Exploring the feasibility of setting up a portable pension fund with insurance companies or other agencies experienced in handling such functions.

It is our belief that progressive mining companies will weigh the idea of a portable pension plan sympathetically if mining engineers indicate their acceptance of the idea.

Incidentally, an article in FORBES, July 15, notes that inflexibility of nearly all pension plans "has tended to make healthy citizens past the age of 45 virtually unemployable."



THE NO. 1 SHAFT of the Zandpan Gold Mining Co. Ltd. will be sunk 7500 ft. A 75-ton bin was built in the headframe with room for a future bin the same size.



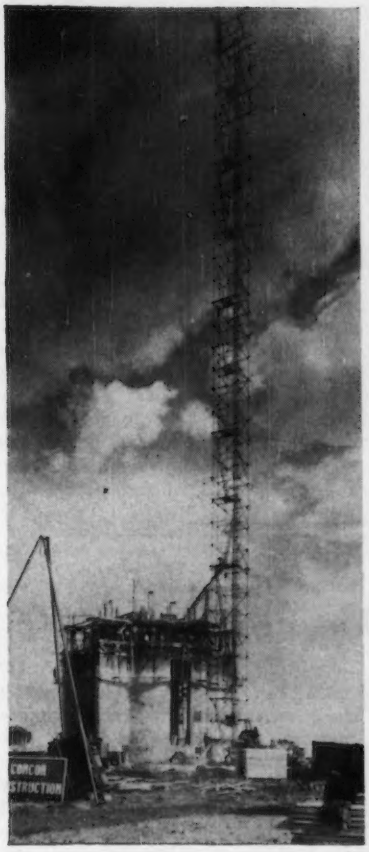
KEY FEATURE of the Siemcrete system is the rigid, re-usable climbing units.

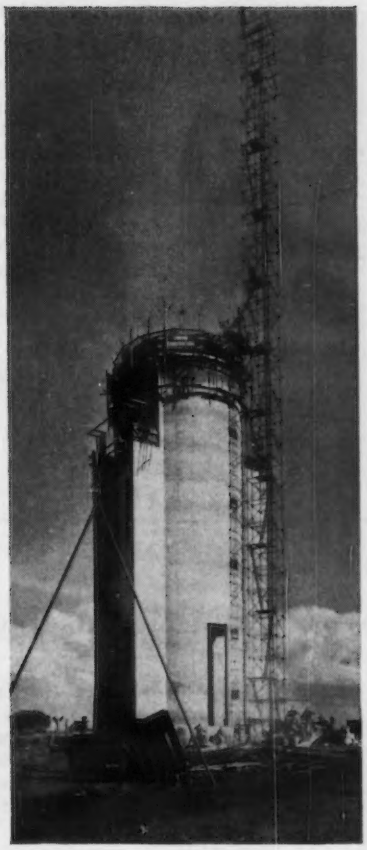
New Sliding

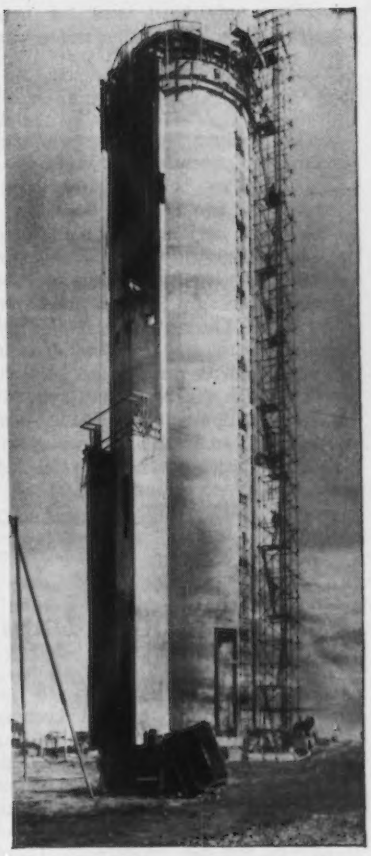
THEODOR CORDES

A SYSTEM OF SLIDING FORMS is used in South Africa for the fast construction of reinforced concrete headframes. By making continuous pours, a 36-ft inside dia headframe was raised from 23 ft to 188 ft in 17 days—an average of 9.7 ft per day or about 5 in. per hour.

Situated at the No. 1 shaft of the Zandpan Gold Mining Co. Ltd., Klerksdorp District, Transvaal, the 18-in. thick headframe was built to support hoist machinery, bearings and sheaves for the hoist ropes. Platforms were provided for assembly and maintenance of the equipment, and the headframe contained skip discharge mechanisms with chutes for discharging the ore into bins. Guides, supporting buntons, operational floors and access stairs were provided as well as equipment at the shaft collar level for the safe and easy handling of men and materials, and for the inter-







RISING an average of 5 in. per hr, 165 ft of this 36-ft inside dia headframe was built in 17 days. Good verticality was achieved—the headframe was less than 1 in. out of plumb in 200 ft. The entire structure was completed in 10 weeks time.

Formwork System Speeds Headframe

change of skips and cages. After a total of 10 weeks elapsed time, Concor Construction Co. Ltd. completed the structure in March 1959. Dr. du Plessis & Partners were consulting engineers for the project.

A massive concrete base for the headframe was built by Zandpan. Two sheave platforms, a 6-ft overhead slab, gantry beams and the ore bin structure were built by Concor and constructed by ordinary methods. The remainder of the headframe, however, was erected by using the Siemcrete system.

The Siemcrete System

The Siemcrete system (as distinct from other sliding formwork systems which use expendable steel rods on which the forms climb) consists of rigid, re-usable climbing units, actuated by hydraulic jacks. The jacks are fixed to the side of the wall of the headframe and are fastened by means of specially shaped concrete blocks and anchor bolts. During the raising progress, the bottom ends of the climbing units are removed from the completed or lower part of the structure and are re-installed higher up. After completion of the structure, all the parts are completely salvaged for use elsewhere. With only four climbing units per jacking point, any height can be reached.

The sliding system carries two platforms; the upper is for receiving materials and the lower is a working platform. Undisturbed working conditions are possible since the working platform is beneath the other, and the workmen are protected against the weather — an important feature because, once started, the construction must continue day and night. The complete system also provides an efficient and strong bracing.

One of the good results of the Siemcrete system is the almost perfect verticality achieved on the projects where it has been used. The Zandpan headframe, for example, showed readings less than 1 in. out of plumb in 200 ft. The accurate results are important because it is not only possible to slide the external concrete shell of the headframe, but also the internal walls which directly support the guide rails. This idea, developed by the consulting engineers of the Anglo Vaal group, of which Zandpan is a member, has resulted in a considerable saving of erection time, together with an economic advantage when compared with the conventional system of steel inside the concrete headgears.

All concrete is vibrated. This means that drier concrete can be used to produce a high ultimate strength.

The Siemcrete system almost eliminates spiralling of the formwork—an important consideration when placing pockets or openings in the structure. And any opening, no matter what size, can be easily constructed. In the Zandpan headframe, a 20x80-ft opening was provided. The system

has not only been used for headframes but also for silos and cooling towers.

The 7500-ft Shaft

The Zandpan headframe will serve a circular, concrete-lined shaft, 26 ft in dia, that will be sunk 7500 ft. During sinking, two 1150 hp hoists and a Blair stage hoist will be used. Later the two hoists will be replaced by two 5145 hp double-drum hoists, each capable of raising a 9-ton payload from 7500 ft. These direct-coupled dc hoists will remain as a final installation along with one of the 1150 hp hoists, which will be used as a service hoist. The rope will have a full speed of 3000 ft per minute, an acceleration of 2.5 ft per second, and a retardation of 3 ft per second.

A bin of 75-ton capacity is in the wall of the headframe; and allowance was made for a future bin of the same size on the brattice wall side of the structure. Provision was also made for 60-lb rail liners in the bins, and for 48-in. discharge conveyor belts to serve the bins.

Crawl beams at the top of the headframe provide for removal of the 19-ft dia sheaves and other gear. The 9-in. thick roof slab has 16 sides and is 50 ft in its greatest dia. The slab is provided with a guard railing 3-ft high.

Basis for dead load calculations due to steelwork and attachments was:

19-ft dia sheave complete with shaft and bearings	10 tons
One set of buntons	7 tons
Steelwork for each platform	4 tons
Crash beams and supporting steelwork	10 tons
Rail lining of each bin	45 tons
Reaction of conveyor gantries	15 tons

Live loads considered were: all ropes operating under normal working conditions, one rope breaking while all other ropes have working loads, weight of rock in bins, and wind pressure. Live loading on all platforms was taken as 100 lb per sq ft, and the permissible ground bearing pressure was 9.5 tons per sq ft.

Safety Training Improves Production as Well as Protection

"MANY A NEW BOSS has started out to 'cut a fat hog' by not keeping up his maintenance work and putting practically every man on production. Maybe he let his track get bad; timber repairs were neglected; ditches were not kept draining; drifts or stopes and manways became cluttered." These are the words of Joseph T. Williams, safety and health supervisor, Bunker Hill Co., Kellog, Idaho.

"The accident figures began to climb and climb. Production climbed too, for a while, and then began to drop off. Men were getting hurt and the crews were becoming afraid to work in some areas. Then a stope was lost, or a bad accident occurred. A look at his production figures reveals that he didn't produce as much as he would if he had just plugged along at a steady pace. You hope he learned that safety and production are partners that must go hand-in-hand.

"But whose fault was it: Was the new boss a dud? Didn't he know that he would eventually get into trouble with that kind of operation? You say he was a good timberman or a good miner or a good mechanic, so what went wrong? Did you expect him to be an expert the first time you gave him a shovel or an axe or mechanic's tools? He didn't begin his trade as a journey-man 'boss' the day we gave him that job.

"Today's enlightened management not only has stopped most of the haphazard selection of men for supervisory positions but has also inaugurated formal supervisory training as a major part of their supervisory development programs. I do not mean to imply, nor do I want you to infer, that in the past we did nothing to train our new bosses. Just as we have changed from hand mucking to the mechanical moving of ore, so also, have we improved our methods of training supervisors.

"At Bunker Hill's operations, a formal supervisory training program has been in operation for more than two years. It began with a study of company policies, went on to contract analysis and interpretation. Management's expectation of a supervisor was another topic. Now, existing rules and regulations are discussed; employee-employer relation problems are studied. The mechanics of management such as accounting, purchasing and warehousing, and so forth, are considered. Communication and directions at all levels are studied.

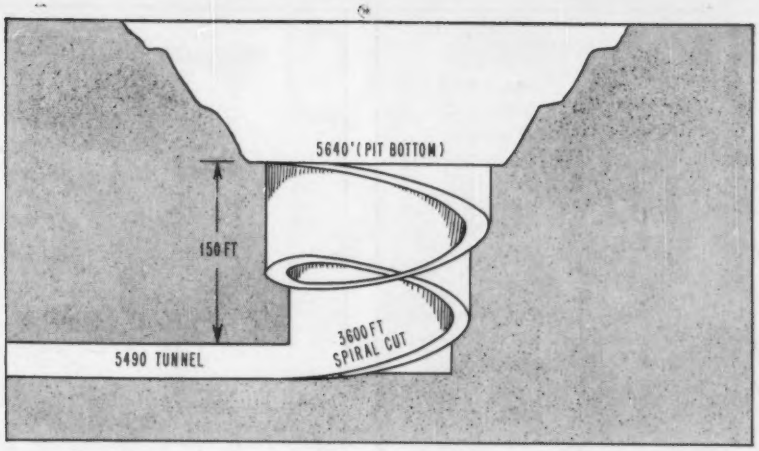
"Time and again, the supervisors themselves have pointed out the economic waste of accidents. It has been a gratifying as well as an enlightening thing to see these men defend their views that the cost and the waste of accidents are all an important part of the many factors that determine whether or not we can stay in business.

"The intangible 'safety assets or results' of a training program are legion. Where better can a boss discuss mutual supervisory problems than in a training meeting? He learns to communicate with other men who have like problems. He can draw from the experience of others. He gets strength from the knowledge that his problems are not his alone, but are the concern of others as well. Where better can a safety department let these men know that their primary purpose is to help the 'boss' take better care of his men.

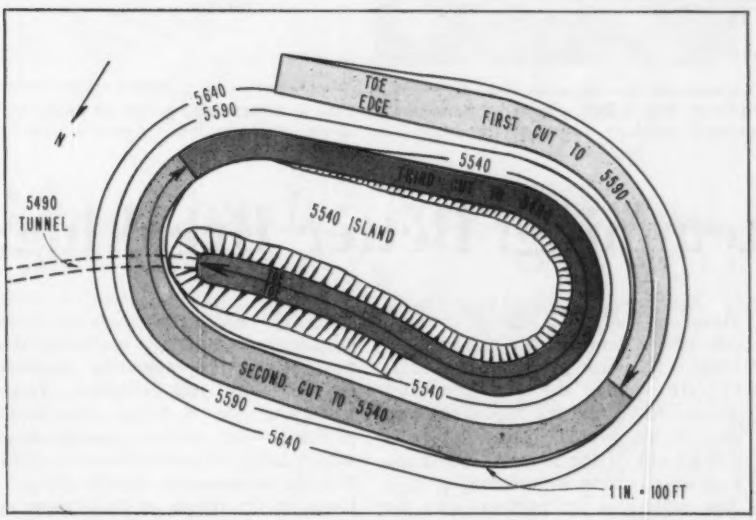
"The first line supervisor is the key man in the safety program. Without top management's honest, sincere desire for a good safety program, any program will fail. The supervisor needs help, assistance and direction. Through supervisory training meetings, safety-conscious bosses tend to inspire those who have given it little thought. The poor supervisors, although on the team, drag down everyone's record and no one wants the derision and ridicule that goes with a bad record.

"As with any other team, training is all important. With training you can watch the supervisor's attitude change. He learns more about his job than ever before. He becomes more realistic about the welfare of his men. The condition and the way in which his men work has more meaning. He sets a better safety example for his men. He begins to live safety, and believes safety, and it is contagious. More than once I have heard the remark, 'That boss means business when he talks safety to you.'

"I am certain that most bosses understand why we need to have accidents investigated and conditions or methods improved. Most bosses can see that accidents are a luxury that no one can afford. We are endeavoring to give our supervisors not just wisdom but understanding as well. Not just 'how' but 'why'—and accident prevention is a large part of 'why.'"



FAST RIPPER-SCRAPER combination will connect the bottom of the Bingham pit to Kennecott's newest ore haulage tunnel in about 9 months time.



SPIRAL will be dropped in three 50-ft steps with all the inside ore removed by the contractor for the first 100 ft. The last 50 ft will remain as an island of ore.

Rippers Make Spiral Cut

A SPIRAL DROP CUT, to be made with a ripper-scraper combination, will connect the bottom of the Bingham pit with Kennecott's newest ore haulage tunnel, 150 ft below the present workings. An independent contractor, Morrison-Knudsen Co. Inc., was awarded contract to speed development of the program that will materially reduce haulage costs at Bingham—rail traffic will be downhill on a 4% grade through the 5490-ft level tunnel instead of uphill to the 5840-ft level haulage tunnel. (Kennecott measures levels in the pit on the basis of elevation from sea level.) In driving the spiral, M-K will remove some 5-million tons of ore by the use of heavy earthmoving equipment, including rippers. Thus, most of the excavating will be done without blasting.

The haulage program was started in October 1956 when Utah Construction Co. began driving the 18x24-ft tunnel to connect the pit bottom with the Copperton (ore and waste train) assembly yards at the mouth of Bingham Canyon. The $11-million tunnel (the longest single-track mine tunnel in the world) was completed Feb. 28, 1959, nine months ahead of schedule and is the third haulage tunnel at Utah Copper. The first (at elevation 6,040 ft) was completed in 1945, having been started during the war. The second (at elevation 5,840 ft), less than half as long as the latest venture, was finished in 1953.

Spiral Is New Drop Method

In driving the spiral, M-K will leave what Utah Copper calls the 5540-ft level "island" of ore looming up from the 5490-ft level. Ultimately the present method of benches at each 50 ft will eliminate the spiral and this island of ore.

The spiral represents a departure from the present benching method. (See "How the Bingham Pit Makes a Dropcut," E&MJ, June 1958.) The present benching method requires five cuts to drop one bench, and can take as long as nine months to complete. On the other hand, it is estimated that the full 150-ft spiral drop will be completed and connected to the tunnel in a similar nine-month period. The spiral now taking shape in the pit ultimately will have a railbed 3,200 ft long on a 4% grade and will handle all ore mined below the 5840-ft level.

By the time the spiral is completed in early 1961, work also will have been finished on drainage, trackage and electrification of the new tunnel, so it can be put to use without delay. One important feature of the tunnel will be centralized traffic control. Already finished is a 150-ft ventilation shaft from the pit to the tunnel's upper terminus.

5-Million Tons To Be Ripped

The spiral contractor plans to do most of the excavating without blasting. Huge rippers will be used to break the rock, then carryalls will scoop it up and carry it to the upper levels, where it will be reloaded into railroad cars. Over 5-million tons of ore will be mined in a nine-month period using this method. (See "Tractor-Ripper Slices Frozen Ground," E&MJ, October 1958; and "Using Seismics to Determine Rippability," E&MJ, June 1960.)

First cut of the spiral grade will be made from the 5640-ft level to the 5590-ft level, a drop of 50 ft. When that grade is made, the remaining material on the 5590-ft level will be removed by the contractor. Next step will be to cut another segment of the spiral descent, from the 5590-ft "plateau" down to the 5540-ft level, a full 100-ft below the original starting point. Then the ore will be removed down to the 5540-ft level. By gradual stages, the remaining 50-ft descent will be attained, dropping from the 5540-ft "flat zone" down to the 5490-ft level. Then there will be a rather long and level approach to the 5490-ft tunnel. This time the ore mass surrounded by the spiral loop will not be removed by the contractor, but will remain an "island" at the 5540-ft level.

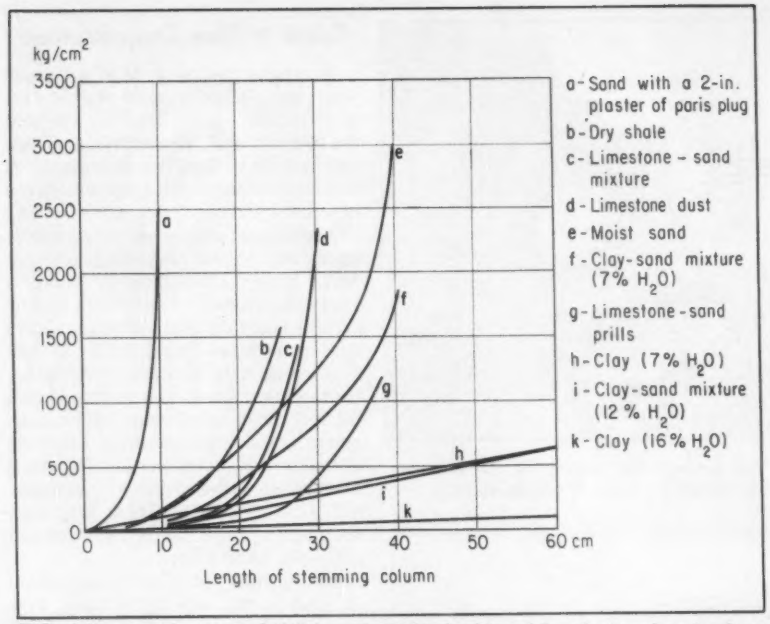


FIG. 1 Pure sand, stemmed tightly and confined with a 2-in. plaster of paris plug, offers the greatest resistance. With increased moisture, resistance decreases.

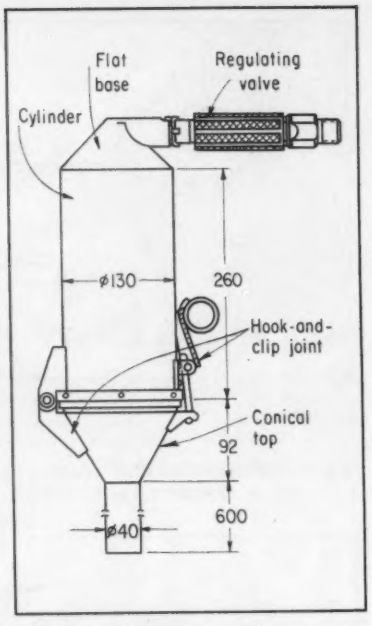


FIG. 2 A stemming gun, such as the one above, can be built in the mine workshop.

Proper Stemming: Better Breaking,

SAMAR BANDYOPADHYAY

STEMMING MATERIALS are judged from the results of blasting. The proper material can give better rock breakage, lower powder consumption, fewer blow-outs, and less gas and dust—depending upon the results desired and the product being mined. The economy of stemming should be judged more by its effectiveness than by the initial cost of stemming.

Clay, sand (which is stemmed with guns in some modern mines), chalk dust (also stemmed with guns and reported to have good dust suppressing qualities), and a gelatinous paste containing more than 90% water are often used. Apart from these, a new type of water cartridge has proved effective. In a modified form, it is equipped with a small chemical ampule which is broken just before being introduced in the shot hole. The resulting chemical reaction causes the water cartridge to bulge and causes tight stemming.

Improper stemming can result in not only higher explosive costs but also in more time spent blowing out shot holes. Work done by explosives can be incomplete because of bad stemming. The objective of stemming a shot hole is: (1) To confine the explosive charge so that it can be detonated (some powder can be detonated only when perfectly confined); (2) To confine the explosive after detonation so that the explosive force may break ground instead of being thrown out of the hole. A blown out shot could cause a methane or coal dust explosion, and explains why the mining laws of most countries specify a minimum length or effectiveness of stemming in gassy coal mines.

Mr. Bandyopadhyay is obtaining his doctorate at Bochum, West Germany.

Clay and Sand

The effectiveness of stemming depends first upon the material used. Clay and sand are the most common materials—clay being plastic and sand non-plastic. A plastic material can withstand the force of detonation as long as the force lies below the elastic limit; but the material is thrown out of the hole when the force goes above this limit, with a thin layer of clay being left on the inner walls of the hole. Sand, on the other hand, offers higher resistance with higher detonating forces. Naturally, above a certain limit, it is also thrown out of the hole.

With a plastic material such as clay, the resistance may be calculated according to $P=\frac{4\,L\,F}{D}$, where P is the resisting pressure, L and D the length and diameter of the stemming column, and F a coefficient dependent on the stemming material (its plasticity and softness). Thus, when the clay is wetter, the value of F is smaller, and the resisting pressure is lower. The formula also shows that the resistance is directly proportional to the length of the stemming column and inversely proportional to its diameter. When the inner walls of the shot-hole are wet (causing a slippery layer on the surface of the stemming column), or when the column has varying moisture content along its length, the above expression does not hold true.

The equation $\frac{4\,K\,U\,L}{D}\,P=P_o$ is used for non-plastic materials. P is the resisting pressure, L and D the length and diameter of the stemming column, K the coefficient of compression and U the coefficient of resistance. $P_o=\frac{C}{K}$, when C is coefficient of cohesion. In this case, the resistance increases much quicker than the length.

Taylor has conducted experiments to find out how different materials offer resistance with varying lengths.[1] Fig. 1 shows the results. Pure sand, when stemmed tightly and confined finally with a 2-in. long plaster of paris plug, offers the greatest resist-

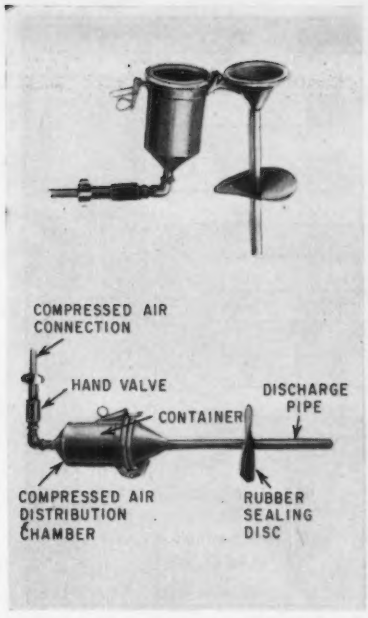


FIG. 3 This versatile gun can handle material that is wet or dry, coarse or fine.

FIG. 4 A 20% savings in explosives is reported by users of the Kota gun.

FIG. 5 Pasty stemming is produced by a gun mixing dust and water at the hole.

Less Powder Needed and Less Dust

ance, followed by clay. The resistance decreases with increasing moisture content in the stemming material. A sand-clay mixture, often used in various mines, offers resistance dependent on the quality of ingredients. The best results have been obtained when the clay is pure kaolin. Fig. 1 also shows that limestone dust or a mixture of limestone and sand offers comparatively low resistance owing to the smaller cofficient of cohesion.

A number of other dusts have found use as stemming material because they are easily available. Salt mines, for example, use the salt dust produced by drilling the shot-holes, basalt quarries use basalt dust, while other mines use washery refuse dust. However, the economy of a stemming material is determined not so much by initial cost as by the results of stemming, the effectiveness of which is shown by reduction of explosive demand and of incidence of blown out shots.

Stemming Guns

Mechanization has been slowly introduced in the field of production and charging of stemming materials. In most mines today, stemming cartridges are hand prepared. However, with a small capital investment, stemming cartridge-pressing machines may be installed underground. The machines can produce about 2,000 cartridges of 6-in. size per hour. A problem associated with sand clay cartridges is that they dry out with time and may be stored for only two or three days, even if they are mixed with hygroscopic salts. In large mines this means a complicated organization problem. In recent years, stemming guns have been introduced to aid in the preparation and transportation of cartridges.

One such gun is illustrated in Fig. 2. Guns of this principle may be constructed easily in mine workshops. This gun consists of a cylinder with a flat base and a conical top which may be opened for filling up the gun. The top is attached to the cylinder by a hook-and-clip joint. Compressed air is introduced at the floor of the gun and is controlled by a regulating valve. The discharge pipe at the front of the gun may be made as long as desired. A metal shield with a rubber ring should be mounted on the pipe to seal the mouth of the drilled shot hole while stemming—otherwise the blown material can stream out of the hole. The material used for stemming (sand is most suitable for such guns) should be so moist (about 2%) that it may form a good stemming column with no danger of electrostatic charging. (See table above.)

Another type of gun, developed by Kota in Hungary (Figs. 3 & 4), has a turbulent effect on the stemming material. Effective stemming may thus be achieved irrespective of coarseness and moistness of the ma-

Comparison Between Hand and Gun Stemming

Mine and drivage no.	Shot-hole no.	Length in meters	Time (in seconds) necessary to stem: With hand total	With hand average	With gun total	With gun average	Efficiency of blasting: Hand-stemming	Efficiency of blasting: Gun-stemming
Mine A, 25	7	2.2	445	64	214	31	0.73	0.93
Mine A, 2	21	1.5	1,590	76	1,088	52	0.52	0.90
Mine B, 2	20	2.1	1,219	61	660	33	0.97	1.10
Mine B, 3	36	1.7	3,033	84	1,899	53	0.46	0.89
Mine C, 1	20	2.1	1,203	62	696	35	0.80	1.00

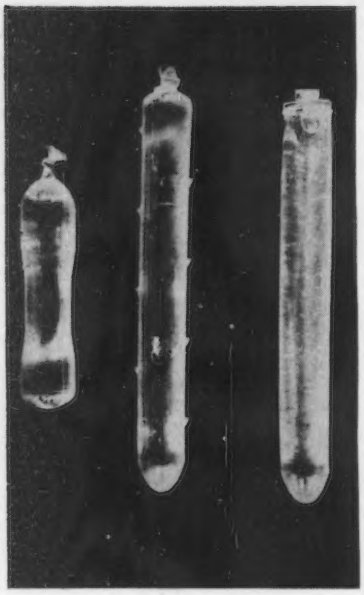


FIG. 6 Water cartridges reduce stemming time 50% compared to clay stemming.

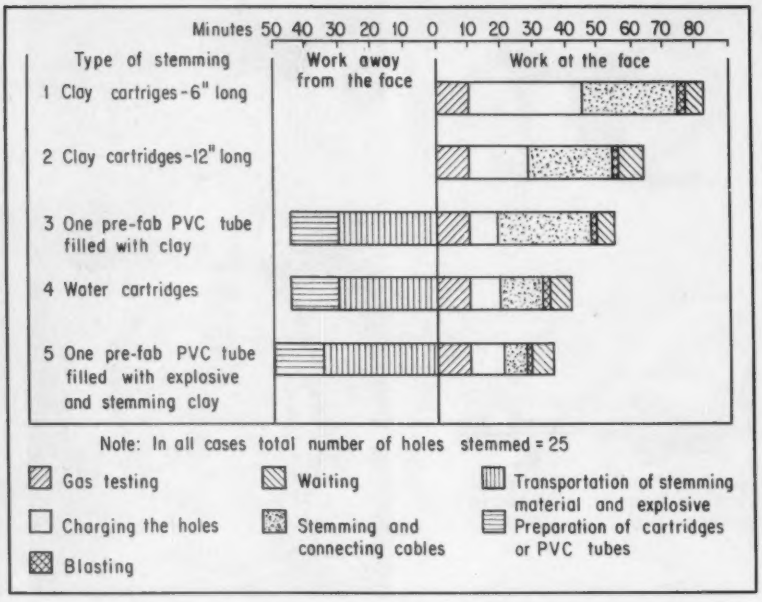

Minutes 50 40 30 20 10 0 10 20 30 40 50 60 70 80
Type of stemming
Work away from the face
Work at the face
1 Clay cartriges-6" long
2 Clay cartridges-12" long
3 One pre-fab PVC tube filled with clay
4 Water cartridges
5 One pre-fab PVC tube filled with explosive and stemming clay
Note: In all cases total number of holes stemmed = 25
Gas testing
Waiting
Transportation of stemming material and explosive
Charging the holes
Stemming and connecting cables
Preparation of cartridges or PVC tubes
Blasting

FIG. 8 Although packing the explosive and stemming material in one plastic tube shows the shortest time demand, it is possible only under special circumstances.

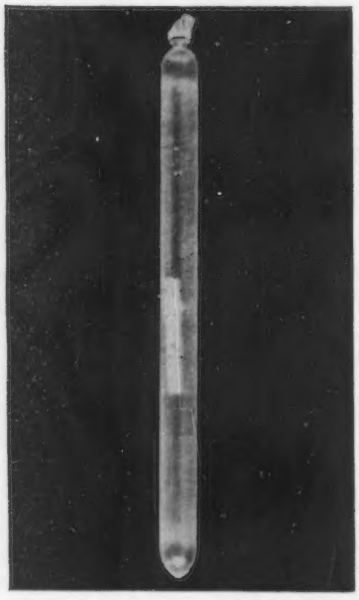


FIG. 7 Glass ampule inside cartridge is broken to chemically produce gas.

terial and irrespective of the direction of the drilled hole. The gun consists of a cylindrical container with a capacity sufficient for stemming one hole. The bottom is conical, and has a compressed air connection pipe. Compressed air is delivered by means of a number of spirally formed jets, which are arranged on the container wall near the bottom. The air stream flowing out tangentially cleans the container thoroughly of the stemming material, even when it is sticky. The compressed air may be regulated by a hand valve. A rubber disc on the discharge tube seals up the mouth of the shot hole so that the stemmed material does not flow out. The time necessary to stem a hole is about 20-25 seconds, a set of 45 holes being stemmed in about 20-25 minutes. In all cases where this gun has been used (it has also been used in Western Europe) a saving of about 20% in the use of explosives has been reported.

In using this or any other type gun, it is important that no electrostatic charges are formed by the friction of dry sand with the metal container. Such charges may cause the detonator to explode. All such guns are generally tried in government testing houses. Often the gun must be grounded. Normally, when the sand is somewhat moist (more than 2%), the equipment has been found to work with adequate safety.

Although the guns described above are suitable for dry or almost dry materials, the gun shown in Fig. 5 may be used for wetter materials such as sand-clay mixtures, clay alone, or limestone dust, all of which are stemmed in a pasty form in the shot hole. In this case the gun is loaded with dry dust and moisture added to the gun. This saves the extra work of wetting and preparing the material to the required pastiness. This gun has a container 16 in. dia and 40 in. high, in which about 220 lb of dust may be loaded. The discharge has actually two pipes: one for water, the other for dust. Dust is carried dry by the compressed air pressure almost to the end of the discharge mouth. Here it is thoroughly mixed with water flowing from the water pipe and forced into the hole at a high velocity. The discharge unit is connected to the container with a long flexible rubber pipe, so that the container may remain stationary while the face is being stemmed. The discharge unit is made of bronze and the water and dust valves are so coupled with each other that the dust valve cannot be operated while the water valve is closed. Experimental tests have shown that the stemming by such a machine is quite effective—a 6-in. long stemming column being sufficient for normal blasting practices in underground faces. The cost of such a unit is $400 in Europe.

The average time necessary to stem a hole (length of stemming column: 0.5 m) is about ¾ minutes when stemming is done by hand. The total time thus necessary for a round of shots in a rock drive with 45 holes is about 35 minutes. A gun may accomplish this work in about 10 to 15 minutes. The price of the clay cartridges for 45 holes works out in European countries to about $1.60. The price of stemming with a gun (90 kg of stone dust is necessary) is only 60¢, the stemming column being about 1 m long.

Water

Water as stemming material has long been considered advantageous, but practical difficulties prevented

FIG. 9 Cylinder on small gun forces the paste into the drill holes at 40 to 50 psi.

FIG. 10 Hydraulic system on large gun boosts air pressure from 40 to 150 psi.

its use. One of the problems was how to confine the water in the hole. Early trials with ordinary rubber tubes filled with water were unsuccessful, as they were thrown out of the hole by the detonating force. With the introduction of new plastic materials, such as polyvinylchloride or polyethylene, cartridges with expanding walls may be produced. Such cartridges, filled with water and the ends sealed with high frequency welding, have been used with success in Belgian mines. One or two cartridges are placed in the shot-hole with a clay plug about 2-in. long and stemmed tightly. The walls of the water cartridges bulge slightly, and they press tightly on the inner walls of the shot hole. The cartridges are about 10 to 12-in. long, 1⅛ to ¼-in. dia and contain 200 cc water. The water may be normal water or a 5% NaCl solution. As high frequency welding can not be used underground, the cartridges must be filled on the surface. To eliminate this inconvenience another type of sealing has been adopted in European mines. In this case, the cartridges are sealed at their neck by a metal ring, which may be aluminum in ore mines and copper or bronze in coal mines. A small portable machine can be installed underground to load the cartridges (Fig. 6) with water at a pressure of 5-7 lb. Then the ring is slipped on the neck by hand and pressed tightly on the neck by the machine. The cost of such cartridges is about 4¢ each in Europe, the cost of stemming 45 holes being $1.80, as against $1.60 with hand made clay cartridges. The time necessary for stemming the holes is, however, only half that required by hand stemming.

To improve the resistance between the water cartridge and the inner wall of the hole, the cartridge may be made of different diameters along its length (Fig. 6). The middle portion, having a smaller diameter, has a wall of more expandable nature than that at the ends. Thus, when the cartridge is stamped in a hole with a small clay plug, the wall at the middle expands and tightly fills the inner walls of the hole. Another method is to fill the cartridge with some cheap chemical and to incorporate a small glass ampule containing a reactive chemical inside the cartridge. Before introducing the cartridge in the hole, the cartridge can be bent slightly along its length, thus breaking the ampule. Fig. 7 shows one such water-filled cartridge to which is added 4 cc citric acid and 25 cc hydrochloric acid of 25% strength. The glass ampule floating inside contains 3 cc sodium carbonate. When the glass ampule is broken, the chemical reaction forms CO_2. The CO_2 bulges the cartridge which now offers a greater resistance to detonating pressure. Of course, care must be taken to use only chemicals that are totally harmless to handle or to breathe, so that accidental bursting of cartridges may not have any harmful results.

Fig. 8 shows a time study conducted to compare the time necessary for stemming holes with different materials. The drive required drilling 15 holes in coal and 10 holes in rock. The different stemming practices used were: (a) Normal 6-in. long clay cartridges stemmed by hand. (b) Extra-long 12-in long clay cartridges stemmed by hand. (In both "a" and "b" the stemming column is 20 in. long, the cartridges 1 in. dia. and the hole 1½ in. dia. About 7 normal or 4 extra-long cartridges are required for each hole.) (c) One plastic tube filled with clay for each hole. (This requires preparing the cartridge away from the face.) (d) One plastic tube filled with the explosive as well as stemming material. (The only work at the face is to introduce the whole plastic tube in the hole and to stamp it with a small clay plug.) (e) Water cartridges.

Fig. 8 shows the time spent for preparing the material away from the face as well as that required at the face. Although packing the explosive and stemming material in one plastic tube shows the shortest time demand, it is possible only under special circumstances. Water cartridges, on the other hand, may be used without any limitation. They have an extra advantage over clay cartridges in that they do not dry out, and, as such, may be stored underground for unlimited time. The material used for water cartridges as well as for tubes for cases mentioned in "c" and "d" above must, of course, be fireproof, like PVC.

Water has also been used in gelatinous form for stemming. Chemicals may be added to water which thicken and form a gelatinous mass containing over 85% water. Such a paste is delivered in mines in sacks and may be stored underground without difficulty. For stemming, guns are used which may be small and handy as shown in Fig. 9 or large, as shown in Fig. 10. The small gun has a cylinder in which the paste may be charged. On admission of compressed air at a pressure of 40-50 psi which acts on a piston inside the cylinder, the paste is forced into the hole at a high pressure. The larger gun has a container with a capacity of 30 litres. The piston working inside this container presses the paste into the hole at about 150 psi. The compressed air is introduced from the air range of the mine at a pressure of 40 to 50 psi and a hydraulic system transforms this to the required high pressure. The discharge unit, a small copper tube, is served by a long rubber tube from the container.

Mineral Wool

Another type of stemming material is mineral wool, which is not hard enough to damage the igniting cables,

but compressible enough to form a high resisting stemming column when pressed with compressed air in the hole.

Owing to its plasticity, it fills the hole completely. The hole is then closed with a mineral wool plug in which a ceramic plug is introduced forcefully to enlarge the mineral wool plug and to allow it to press tightly on the hole-wall. In case of a misfire, this ceramic plug may be removed and the mineral wool taken out of the hole. To give extra resistance by friction, the mineral wool may be treated with a clay solution so that they will not be thrown out of the hole by the detonation shock, even if the wall of the hole is smooth.

Dust Control

Apart from the resistance of the stemming column, the influence of the stemming material and the method of stemming on the production of dust after blasting must be considered when choosing a particular material or method. In some countries, like Germany, the use of sand as stemming material is prohibited by law owing to the danger of silicosis that may be caused by the fine sand particles. Limestone dust, on the other hand, is supposed to have a retarding influence on silicosis. From recent experiments it appears, however, that the mineral composition of the stemming material may influence the mineral composition of the dust raised by the blasting only to a very limited extent. The mineral composition of the dust disseminated in air after blasting has been found often to be the same with clay stemming containing 5 to 8% quartz and sand stemming containing more than 80% quartz. The effectiveness of shot-firing, on the other hand, seems to play a big role in production of dust. In all experiments, where a round of shots could not break the ground effectively, much of the blasting force which remained in excess stirred up much dust. The same applies to different types of stemming materials; when the stemming material offers more resistance (thus confining the explosive effectively) the explosive force is used to break the ground and little extra force remains to stir up a large quantity of dust. Thus, the more moisture that is present in one particular type of material, say sand, the less is its resistance and, consequently, the more is its dust production. Stemming with guns invariably causes a good compaction, effective confinement of the explosive wave, and less production of fine dust dangerous to lungs. Water cartridges, however, have proved to suppress the fine dust most effectively. The use of one cartridge per hole has been found to cause only 40% of the dust produced by blasting with clay cartridges when hand stemmed. When two water cartridges are used per hole, this value drops to about 20%. Stemming with guns produces about 40-60% of the dust produced by hand stemming, depending on the type of material and the compactness.

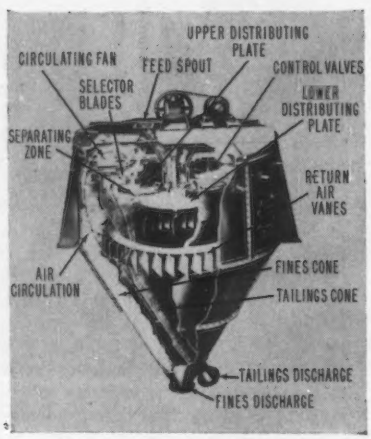
The use of millisecond detonators at a mine face requires special attention to stemming. In contrast to the use of normal detonators by which the ground is broken by a sudden pressure which passes away quickly, the use of millisecond detonators results in a number of pressure waves at small intervals of a few milliseconds. The ground is thus subjected to pressure and shocks for a longer time. The stemming column must be strong enough to withstand this. Lastly, good stemming results in the production of much smaller quantities of blasting gases containing nitrous fumes.

References

1 Taylor, "The resistance of stemming: statical investigations," COLLIERY GUARDIAN (157), 1938, p 803.

2 Anon, "Uber das Besetzen von Sprenglochern mit einem Druckluftbesatzgerat," BERGBAUTECHNIK (8), 1958, p 211.

3 Wild and Boldt, "Beschleunigter Flozstreckenvortrieb unter besonderer," BERUCKSICHTIGUNG DER SCHIEBARBEIT. Nobel Hefte, 1958, p 202.



FEED is distributed by a rotating plate to an air-current separating zone.

Air Separators Classify Asbestos

CRUDE ASBESTOS FIBER often is unuseable as mined because it contains 3 to 6% "rock" or granular material and the fibers themselves must first be opened and processed. Lengthy "pencils"—unopened fibers—must be removed from many asbestos and products. Granular pieces can make finished insulated sheet material inconsistent and can damage the surface as well. In asbestos cements and floats, as in plastics where asbestos serves as filler material, all oversize and grit must be removed. For these applications, all material should be 65 mesh or smaller.

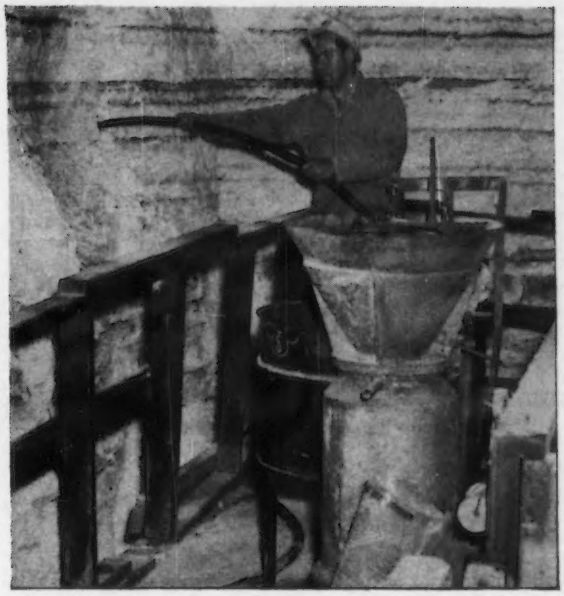
A mechanical air separation technique was adopted at the Johns-Manville processing mill in Asbestos, Quebec, in 1953, and a "by-product" operation initiated. The new facility now serves the plastics industry, offering inexpensive filler. Other finished by-products also are sold for asbestos cements and floats.

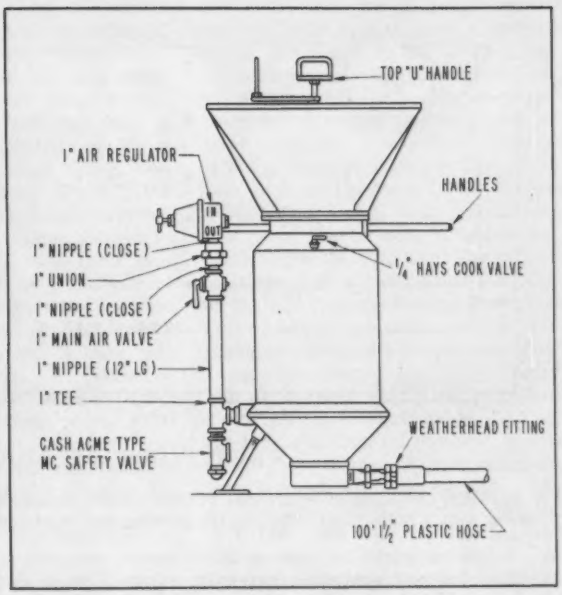
Six Units Vary Grades

Two Sturtevant separators, 8 ft in dia, are powered by 20-hp motors; three are 10-footers, with 30-hp motors, and the remaining classifier is a 12-ft unit, powered by a 50-hp engine. All are used to separate granular and unopened fiber particles from fully-opened fibers from the fibrous asbestos feed. The 8-ft unit can select just under a ton an hour of the low density material; the 12-footer can handle several tons. Oversize particles are recycled, or used for less exacting applications, such as siding shingles and papers for roofing.

Separators Are Flexible

The asbestos is fed into the units from specially designed feeders. Upon entering a separator, the material passes down a chute which delivers it onto the center of a revolving, distributing plate. The material is spun off the outer edge of the plate in a thin, even, horizontal circular spray. The upper fan whirls and sucks the fibrous material upwards through the top opening of the inner casing, while a secondary lower fan, running close to the opening, whirls the upcoming material. The action centrifugally forces the predominantly oversize material away from the opening, baffling and forcibly batting away any oversize which attempts to pass up and out of the unit with the desired fines. By regulating and controlling the centrifugal force and air currents, one counteracting and overbalancing the other, almost any desired fineness can be selected.





FIVE TO EIGHT lb of uncoated prilled ammonium nitrate-fuel oil mixture is blown at 30 psi into each hole. One man handles the hose, another handles the Jetloder. As the A-N enters the hole, the hose is withdrawn, and the mixture packed.

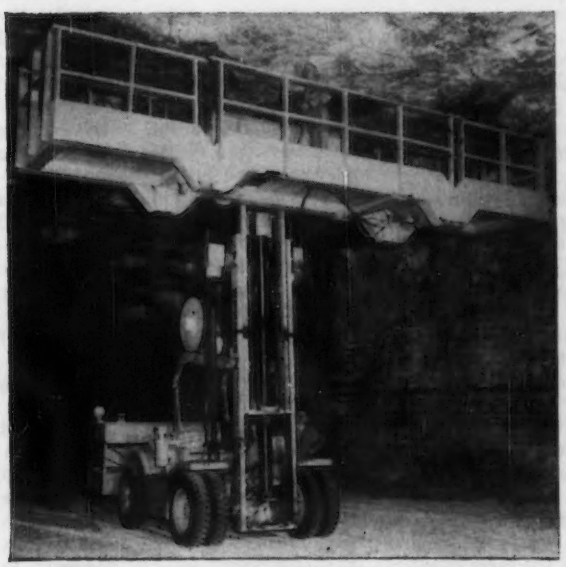
Underground Blasting With A-N

JOHN L. RYON, JR.

THE DETROIT SALT MINE'S switch from dynamite to ammonium nitrate explosives has brought excellent results. At Detroit, not only is ammonium nitrate cheaper (3½c per lb compared with 18c to 20c per lb for dynamite) but fragmentation is superior to that caused by dynamite. Ammonium nitrate is safe; in repeated checks, International Salt Co. Inc. found no trace of static electricity nor any excess carbon monoxide or oxides of nitrogen. Also, the former transportation and storage problems have been largely eliminated.

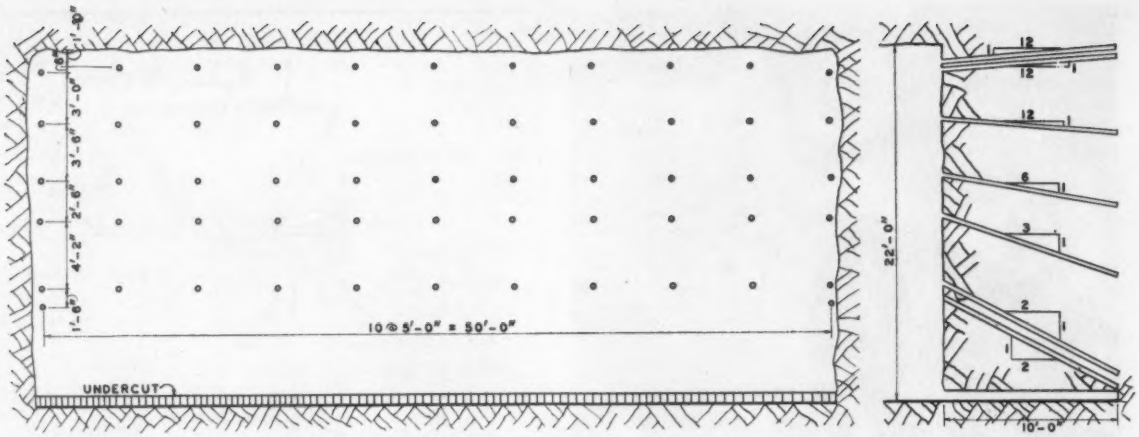
At Detroit blasting operations are presently performed cheaper and more satisfactorily than ever before, and after a full year of experience with the use of ammonium nitrate fuel oil mixture for blasting on a regular production basis, we are more

Mr. Ryon is assistant director of production for International Salt Co. Inc., Detroit, Mich. The article was originally presented at the fifth annual symposium on Mining Research, Rolla, Mo., and abstracted in the E&MJ Guidebook.



REMOTE CONTROLS permit shot loaders to control elevation of insulated platform on which the loading equipment is placed.

PORTABLE 275-gal fuel oil tank has pump, meter and nozzle for the metering of 6% fuel oil to the ammonium nitrate.



FACE VIEW OF DRILL ROUND SIDE VIEW

A PRIMER consisting of a cartridge of high velocity dynamite primed with a millisecond delay electric blasting cap, is placed in the back of each hole. After all holes are loaded, cap leg wires are connected for blasting. No stemming is used.

sold on the new operation than ever.

Repeated checks for concentrations of carbon monoxide and oxides of nitrogen have, without exception, been found well within allowable limits. We have also repeated checks for traces of static electricity in drill holes loaded with ammonium nitrate by the pneumatic placement method and again without exception we have failed to pick up any readings. Several authoritative sources have been contacted for information concerning static electricity, and we have received reports that in their opinion no unsafe practice is involved in blowing prilled ammonium nitrate over cap leg wires. In addition to contacting the technical division of one of the country's leading electrical utility companies and one of the country's leading electrical equipment manufacturing companies, we also contacted the Div. of Industrial Safety, Dept. of Industrial Relations for the state of California. In California it has been common practice for many years for mining and construction industries to blow explosives over cap leg wires. The California Div. of Industrial Safety approves the practice providing that the air loader and the loading pipe are effectively grounded and providing, of course, that other commonly accepted rules of safety involving the handling of explosives are followed.

Fragmentation is excellent and, we believe, superior to that experienced in using dynamite. There are practically no large chunks and a minimum of fines. The face profile is vastly improved in that there is a slight toeing out of the room at the bottom with no overhang. In other words, the face of the room tends to be slightly concave, which greatly simplifies final cleaning of rooms prior to undercutting. This is done with a front end loader. The improved profile of the faces also allows getting a full cut with the undercutter bar.

Pound-for-pound we have found that ammonium nitrate-fuel oil mixture for blasting gives at least equivalent performance when compared to dynamite. At 3½c per lb for ammonium nitrate compared to 18c to 20c per lb for dynamite, the cost economy of this change is obvious. Our other mines are experimenting with the use of this material for blasting in the hope that in the near future they can make the change. We anticipate using prills exclusively for all blasting at our new rock salt mine to be located in Cleveland, Ohio. This mine is located within the city limits and city ordinances place specific limits on the quantities of dynamite to be transported and stored at locations within the city. Thus, while we might be seriously inconvenienced in the handling of dynamite for mine blasting, we expect no difficulty with the transporting and storing of ammonium nitrate.

International Salt Co. operates three evaporating refineries and three rock salt mines at Retsof, N. Y.; Avery Island, La.; and Detroit, Mich. A fourth mine is under construction at Cleveland, Ohio. This mine will be in production in the summer of 1960. The ammonium-nitrate blasting operation is being used at the Detroit mine.

Until about three years ago, the International Salt Co.'s Detroit mine was the only rock salt mine located in the midwest area east of Kansas. Within months from now, there will be five rock salt mines in the general area, all with about the same capacity as the Detroit mine. The demand for rock salt is increasing with amazing speed but it is not expected to increase to the extent necessary to handle capacity shipments from all mines. International, therefore, is anticipating a period of severe competition and is concentrating more diligently than ever on reducing costs in all areas.

The following is a brief outline of the operation at Detroit. The bed of salt we are mining lies about 1,150 ft below the surface. We are using the room and pillar method of mining, driving rooms, crosscuts and headings 50 ft wide. Mined height ranges from 23 to 26 ft leaving 4 to 5 ft of salt in the roof for support of the overlying shaly dolomite.

Each working face is first undercut to a depth of 10 ft. Holes are then drilled with four hydraulic drills mounted on a rubber-tired rig. We are drilling holes 2¼ in. in dia by 11 to 13 ft deep. There are 57 holes per face. (See drawing of typical drilled face.) Each face is primed with dynamite and millisecond delay blasting caps and then loaded by pneumatic placement of prilled ammonium nitrate fuel oil mixture. Each blast in each room brings down about 900 tons of salt. Because particles of copper are objectionable in salt for hide curing, a special aluminum blasting cap with iron leg wires is used. International Salt Co. pioneered the use of the special caps, which are used almost exclusively in the salt mining industry today.

After blasting, the salt is loaded with electric power shovels with 2¼ yd buckets into 22-ton capacity bottom dump electric trucks for haulage to the primary crusher. The salt is then crushed to 8 in. down to dust and transported by belt conveyor to our underground preparation station where the salt is further crushed and

screened to appropriate grade size.

The salt then proceeds to underground storage or to the hoist. Our underground storage facilities can accommodate about 150,000 tons of graded salt. This salt is stored along our main line conveyors for easy reclamation by means of power shovels and reclamation conveyors which load stored salt back onto the main line conveyor system. On the surface the salt is given a final screening and loaded into rail cars, trucks and boats.

We also store up to 100,000 tons of salt on the surface. Salt is placed into storage during slack periods of spring and early summer and then reclaimed in the fall and winter. (Salt for snow and ice control represents about 45% of our business.)

Shipments to customers are running consistently in excess of 1-million tpy of rock salt.

The product mined is known as halite and, at our Detroit mine, consists of about 98% sodium chloride with the remaining 2% consisting primarily of banded impurities of anhydrite and dolomite.

The mine is dry with no gas. Roof conditions are good requiring generally no additional support other than the 4 or 5 ft of salt left on the roof.

The A-N Study

In the early summer of 1958, several field trips were made to observe ammonium nitrate-fuel oil blasting at other locations. The trips were made for the most part in Ohio as the Div. of Mines in this state approves the use of ammonium nitrate-fuel oil mixture for blasting in underground mining operations. Through these trips, subsequent talks with powder company engineers and technicians, and correspondence with others who had some experience in this field, a great deal was learned about the recent developments concerning the use of ammonium nitrate. We tried blasting a few rooms with the ammonium nitrate loaded into tamping bags and then placed into drill holes; but, while the results were encouraging, the time required to package the ammonium nitrate was excessive and the operation was, at best, messy.

It was at this time that we began to seriously investigate the possibility of pneumatic placement of the bulk ammonium nitrate in our drill holes. We contacted Atlas Powder Co. and arranged to have a group of their technical people visit our mine and experiment with pneumatic placement of the A-N. The Atlas group was headed by John Jeffries, manager of special accounts. We tried various combinations of primers, fuel oil mixtures and drill patterns; and, after each blast, readings were taken to determine concentrations of carbon monoxide and oxides of nitrogen. The results showed that even immediately after the blast the concentrations were well below those figures outlined for prolonged exposure as found in the U. S. Bureau of Mines Circular No. 33, "Mine Gases and Methods of Detecting Them." We also found that from merely a physical observation the fumes seemed to be less objectionable than those previously experienced with the use of dynamite for blasting. Attempts were also made to get static voltage readings as the ammonium nitrate was placed in drill holes. No show of static voltage could be detected. Any amount of static voltage on the prills of ammonium nitrate apparently goes to ground through the salt body as the prills are blown into place in the drill hole.

Experimentation was continued to determine where the dynamite primer should be located in each hole to obtain the best results. After systematically trying various locations and combinations, it became evident that best results were realized when the primer was placed in the back of the drill hole. Fragmentation proved excellent and at the conclusion of the experimental work it was obvious that the operation was sound and that excellent results could be obtained. After a careful review of procedures, the operation was put on a production basis.

We purchased a pneumatic placement machine from the Atlas Powder Co. and an air compressor rated at 130 cfm of free air delivered at 40 psi. These were mounted on our loading rig, which consists of a large pneumatically tired fork lift truck. A fully insulated platform has been constructed on the forks and remote controls permit the shot loaders to control the elevation of the platform from their working position on the platform. (See picture.) The "Jetloder" is located on the elevating platform. The compressor is located at the rear of the rig with the air line going to the loading machine.

Fuel Oil Added By Portable Tank

Present operational procedure begins with the metering of 6% fuel oil into the opened bags of ammonium nitrate. A portable 275-gal fuel oil tank has been constructed and is complete with pump, meter and nozzle for addition of fuel oil to the ammonium nitrate. As each 50-lb polyethylene bag receives its portion of fuel oil, a bell rings signalling the employee to move the nozzle to the next bag.

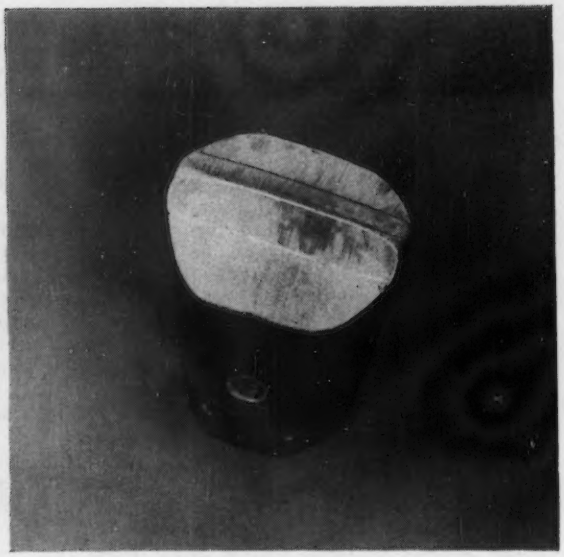
The bags, with fuel oil added, are allowed to stand for at least 24 hours and are then loaded onto a special trailer and taken to the loading rig.

Loading is a two man operation: one man handles the loading hose; the other man is at the pneumatic placement machine. The primer consists of a cartridge of high velocity dynamite such as Du Pont Gelex #1 or Atlas Gelodyn #1, 1 in. in dia and 8 in. long primed with a millisecond delay electric blasting cap. The primer cartridge is then pushed into the back of the hole with the loading hose. The loading hose is a plastic pipe 1 in. ID. In the meantime the proper charge of ammonium nitrate has been placed into the hopper of the loader. When the primer is in place in the back of the hole, the man on the hose signals to blow the charge of ammonium nitrate through the hose into the hole. As the ammonium nitrate enters the drill hole, the hose is retracted and the ammonium nitrate packs into the hole. Five to eight pounds of ammonium nitrate, depending on the location of the hole, are blown into each hole. An air regulating valve delivers air from the compressor to the loader at 30 psi. The dynamite primer represents about 4% by weight of the charge of ammonium nitrate. No stemming is used.

Uncoated Prilled A-N Is Used

We originally found it necessary to blow the cuttings out of the drill holes before blowing in the ammonium nitrate in order to get complete detonation of the ammonium nitrate. At that time we were using prills with a coating of 2% to 4% of diatomaceous earth. This coating is added to keep the ammonium nitrate from caking. The coating, however, tends to desensitize the ammonium nitrate fuel oil mixture. We are now using Spencer Chemical Co.'s N IV ammonium nitrate, which is an uncoated prilled ammonium nitrate. This material has a special surface treatment which keeps it from caking in storage. When we changed to the N IV ammonium nitrate, we found it no longer necessary to blow the drill cuttings out of the holes. We also found that we could use a smaller primer.

After all holes are loaded, cap leg wires are connected for blasting and the room is tested. The rooms are detonated after the afternoon shift has left the working faces. We have no midnight production shift and, therefore, no employees are at the working faces between the end of the afternoon shift and the beginning of the day shift. This allows at least 5 to 6 hr for the smoke to clear from the working face area.



ROCK DRILLS retipped and manufactured by the process described have proved equal in performance to any drills obtained from other suppliers, both Australian and overseas. Use of retipped drill steel results in a 50% saving in drilling costs.

12 Steps to Retip TC Drill Steel

J. A. BROWN

A SUCCESSFUL TECHNIQUE for the retipping and manufacture of tungsten carbide integral rock drill steel has been developed at the Zinc Corp. Ltd., Broken Hill, Australia. The technique is based on the use of a high temperature liquid salt bath.

Retipping of used drill steel is now carried out as a routine, and assuming a supply of used steel for retipping, the company is achieving a 50% savings in drilling costs compared with the use of new imported steel. The company has found that alloy drill steel is capable of carrying a second tungsten carbide insert without reaching the end of its fatigue life.

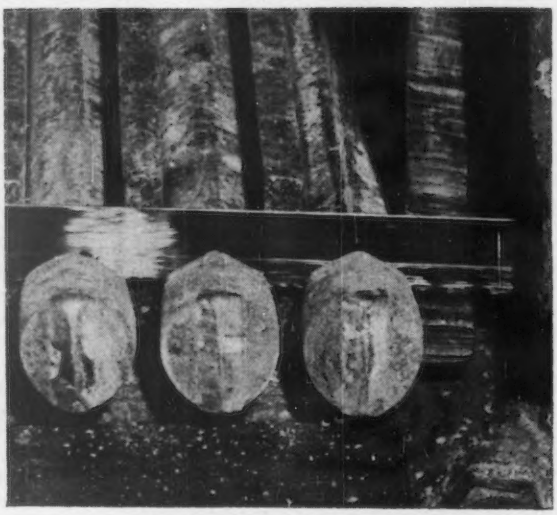
Early in 1955 the existence of large stocks of Swedish drill steel having worn or broken tungsten carbide tips prompted investigation into the possibility of recovering the major portion of these drills by reforming the head and brazing in a new tungsten carbide insert. A satisfactory technique was evolved from detailed study-and-methods experiments of each operation involved. Performance of retipped drills has proved to be satisfactory and has justified the installation of equipment capable of retipping approximately 15,000 drill steel per year in accordance with the following current process.

1. Steel Selection and Cutting to Lengths

The shanks of the drills are examined to ensure they are in good condition, true to size and the water hole undamaged. Drills must be free from cuts or marks which might act as stress raisers and result in early failure of the drill. Badly corroded steels are not suitable for retipping.

A metal cutting band saw is used to cut off the old bit head just below the side water hole or to cut the steel to a given length. It is proposed to replace the metal cutting band saw with an abrasive cut-off wheel.

Mr. Brown is the rock drill shop foreman for the Zinc Corp. Ltd., Broken Hill, Australia.



The mine steel lengths are 11 ft 10 in., 7 ft 10 in., 5 ft 3 in., 3 ft 10 in. and 2 ft 10 in. Of these sizes approximately 80% of the steel used are the 7 ft 10 in. and 3 ft 10 in. length. At present the minimum reduction in length for retipping is 3 in.; this reduction in length being acceptable for all sizes excepting 7 ft 10 in. units. The 7 ft 10 in. units are therefore manufactured from either worn 11 ft 10 in. steel or new steel.

2. Forging the Bit Heads

Four inches of the drill are heated slowly and uniformly in an oil-fired drill heating furnace to a temperature of 1150° C. The drill is then forged in an IR-40 drill sharpener equipped with dies and a dolly designed to produce the conventional bit upset.

The first forging operation consists of clamping the drill and running the dolly hammer for five seconds, causing a partial upset of the head. The forged end is then removed from the sharpener and compressed-air blown through the water hole from the heated end in order to clean all water-hole scale from the upset area. Heavy scale in the water hole will prevent complete closure in the bit upset.

After blowing, the drill is returned to the dies for further upsetting which must cease when the drill temperature falls to 870° C. The steel is then returned to the furnace and reheated to 1150° C. When returned to the sharpener, further dollying completely fills the dies—producing the desired upset head. The final operation is to swage the bit head by operating the crosshead several times while holding the drill steel firmly in the dies, thereby closing the water hole in the bit head area. On completion of forging, drills are allowed to cool in still air to room temperature.

3. Annealing the Bit Heads

In order to soften the bit heads to permit easy machining of the slot and drilling of the water hole, a "subcritical" annealing treatment is employed. The drill bit heads are placed on a carrier plate and suspended in a lead bath to a depth of 1½ in. The temperature of the lead is maintained at 725° C and drills are heated for 25 minutes after which they are removed and allowed to cool in still air.

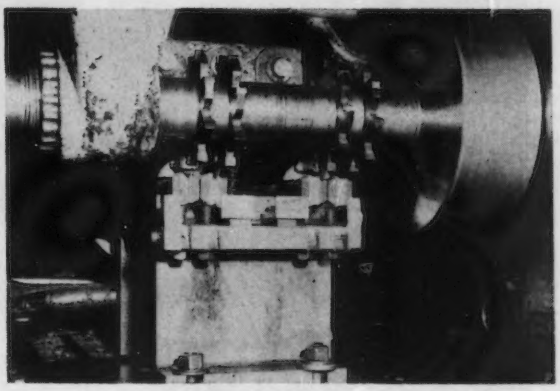
4. Drilling Water Hole

The water hole is drilled prior to milling the insert slot in order to test the hardness of the bit head. The cost of damage to the 7/32 in. drill due to improper annealing is far less expensive than damage to the TC tipped milling cutters used for machining the slot.

A special jig has been designed to hold and locate the bit head in correct relation with an angle-mounted sensitive drill. The 7/32-in. drill is rotated at 800 rpm and hand fed. Standard high speed twist drills have been found to be unsuitable and high tungsten cobalt steel twist drills are used.

5. Milling the Slot

The tungsten carbide insert slots, 0.420-in. wide and 19/32-in. deep, are milled four at a time in a Craven "Rigid" plain milling machine. A pneumatic clamping jig attached to the work table is used to hold and locate the bit heads while they are slotted by means of a vertical milling operation using four 8-tooth tungsten carbide-tipped milling cutters, gang mounted on the horizontal arbor. The peripheral speed of the cutters is 250 ft per minute and



the feed rate is 5 in. per minute. Every care is taken to eliminate chatter marks in the slot bottom. The bulk of the material is removed by a roughing cut, which is followed by a finishing cut 0.030-in. deep. The cutter teeth are staggered and a flywheel is attached to the arbor to reduce chatter. The life of the cutters is approximately 150 steels per sharpening. A grinding attachment has been made to enable the slot bottoms to be ground as a further measure to improve slot bottom finish.

6. Protection for Storage

Production schedules do not require drills to be prepared for brazing immediately following the milling of the slot. It is, therefore, essential that the slots be protected from rusting. This is carried out by standing the drill bit head down in a bath containing a preserving compound of sufficient depth to cover the slot. This compound provides excellent protection against rust and is easily removed with carbon tetrachloride prior to assembly for brazing.

7. Assembly for Brazing

The drill is removed from the preserving tank and placed in a vise at the assembly station. A hole in the floor below the vise enables the bit end of the steel to be held at a convenient level.

The slot is degreased by thorough brushing, using carbon-tetrachloride. The bit head is carefully inspected to ensure that the water hole in the slot bottom is completely closed, and that all minute pieces of steel from the milling operation have been removed.

The tungsten carbide inserts are purchased with ground sides and lapped base. These inserts are now being manufactured in Australia from imported powder. It is believed that they are 9% cobalt and medium to coarse grain size with a VPH hardness of 1,280. Insert dimensions are 18 mm deep, 10 mm thick and either 32, 34, 35, 36, or 38 mm wide, depending on the length of steel required. The cutting angle is 110° and radius of curvature of the cutting edge is 6 in.

To remove any dirt or tarnish from insert surfaces which would prevent complete "wetting" of the carbide during brazing, all inserts are polished on a canvas-covered polishing head using a fine silicon carbide cutting powder.

The brazing alloy (97% Cu, 2.5% Ni and 0.5% Si)

is purchased in strips 1½-in. long x 5/16-in. wide and ⅛-in. thick. It is necessary that they be thoroughly cleaned. The cleaned strips are held in a bath of carbon tetrachloride until they are required for assembly.

Assembly is carried out by placing an alloy strip in the bottom of the slot and positioning the insert on top of the alloy strip. Two U-shaped mild steel spacer pieces made from 0.012-in. thick x 1/16-in. wide skim stock are placed over the insert to locate it in the center of the slot. They are placed approximately ⅜-in. from each end of the slot, and ensure uniform thickness of braze on both sides of the insert. A horizontal wire cradle is then fitted around the assembly midway between the bottom and top of the slot. The purpose of this wire is to prevent side movement of the insert and to centralize it in the slot. Another wire, placed over the insert and secured to the bit head, maintains the insert and braze alloy in place when the drill is inverted to the brazing position.

8. Brazing Furnace

A 75 kva high temperature electric salt bath is used as the heating medium for brazing. This furnace is equipped with three immersed electrodes set at 120° C intervals inside a ceramic pot. Electrodes are of the water-cooled type. The pot is 24-in. deep and has a working area 12-in. dia inside the electrodes. Temperature control is by means of a "Rayotube" connected to a calibrated pyrometer. The Rayotube is positioned in a water-cooled mounting which also has a built-in air nozzle. Attached to the mounting is a 3-in. dia x 18-in. long steel sighting tube extending towards the top of the bath. The open end of the sighting tube is held approximately 4 in. above the molten salt and sighted into an area of the bath which is always exposed. The air nozzle prevents vapor from the bath fouling the window of the Rayotube, as this window must be clean to provide accurate temperature control. Temperature differential is 15° C when the bath is in operation.

The salt used for brazing is a high temperature type, with a melting point of 680° C, and has a working range from 770° C to 1180° C. Manual salt rectification is required and is always carried out prior to brazing. After addition of the rectifier salt to the bath, all impurities are cleaned from the top of the bath, and the bath dredged to remove any sludge from the bottom of the pot.

The furnace has an attached super-structure consisting of a movable crosshead which moves vertically between two guide posts attached to the furnace. A semicircular 10x5x1-in. carrier plate is attached to the bottom of the crosshead by three 8-in. x ⅞-in. dia rods. The purpose of the crosshead assembly and carrier plate is to support the drills in a vertical position and enable them to be immersed to a depth 3 in. below the top of the salt during the brazing operation. Movement of the carrier plate is effected by means of a cable and hand winch. The electrodes, carrier plate and carrier support rods are all made from 25/20 heat-resisting steel.

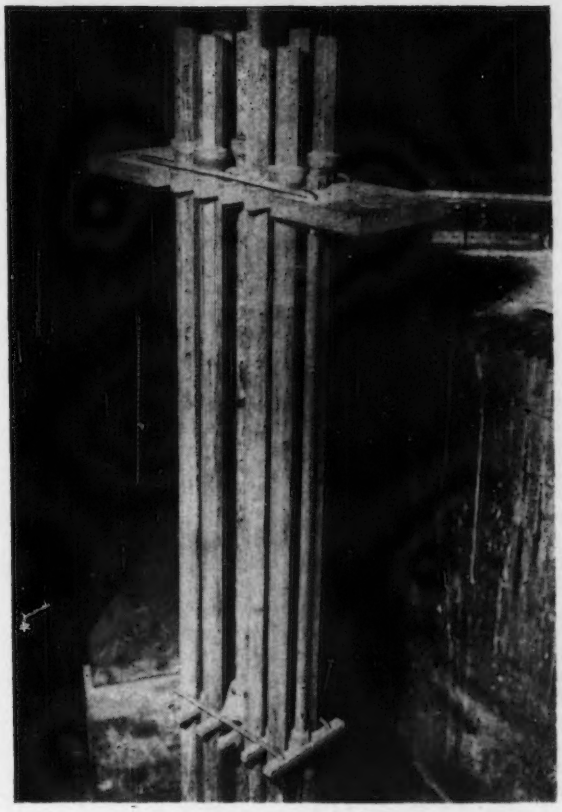
9. Loading Rack

A loading rack is provided to enable drills to be handled eight at a time on and off the salt bath furnace carrier plate. The rack is made of two mild steel spacing plates having slots on each side to accommodate four drills. The plates are held in a horizontal position, 2-ft apart for 3-ft 10-in. drills, and 3-ft 9-in. apart for 7 ft 10-in. drills by means of spreader bolts. The drills fit into the slots and are prevented from moving by locking bars extending across the slots on each side of both plates.

Each rack has an eye bolt attached to the top plate to which is connected a cable from a hand winch for lifting each batch on and off the carrier plate. Provision is also made for locking the loading rack to the crosshead, by means of holes in the loading rack plate engaging pins fixed to the crosshead.

10. Brazing

The bath having been rectified, the carrier plate is lowered to the brazing position, i.e., 3-in. below the level



of the salt. The temperature of the bath is raised to the brazing temperature 1140° C/1155° C and the furnace allowed to cycle at this temperature for 5 minutes to ensure that the carrier plate has attained the temperature of the bath. The bath is then ready to commence continuous operation.

Eight drills are then placed in the lifting rack and raised by the winch and located on the carrier plate in the bath. Immersion time is measured by means of a stop watch.

After the drills have been in the salt for 2.5 minutes, a load of approximately 30 lb is applied to the shank of each drill. This is done to force the insert against the base of the slot and thereby attain the minimum film thickness of braze alloy between the slot base and the insert. The maximum desirable braze film thickness between insert and slot base is 0.002 in.

When three minutes have elapsed the carrier plate is raised to a position 5 in. above the salt. In this position the drills are allowed to cool for a period of one minute, sufficient to enable the braze alloy to solidify. After cooling, the drills are blown through with compressed air to remove any salt which may block the water hole. Should the drills be moved or blown-out before the alloy freezes, the inserts would be unseated and the braze would be so damaged as to be useless.

After blowing-out, the loading rack is lifted from the carrier plate and placed on the shop floor where the drills are unloaded from the rack and placed on a cooling rack and allowed to cool in air to room temperature.

Immediately after the drills are taken from the carrier plate, the crosshead is lowered to return the carrier plate to the brazing position to await the next batch of drills. The complete brazing cycle time is five minutes.

Salt bath brazing has proved to be a satisfactory technique provided the following operating points are closely watched: (a) The operator must wear goggles, gloves and spats for personal safety. (b) All work must be thoroughly dry before it enters the bath, otherwise dangerous splattering will occur. (c) So called "neutral" salts used in salt baths tend to become alkaline after continuous use. This condition has a tendency to cause decarburization of the material being treated (in this case the drill steel), hence the need for rectification as previously described.

11. Cooling Rack

This rack is built from steel tubing and is 14-ft long 3-ft 9-in. wide and 3-ft 9-in. high and has three tiers at 1-ft 3-in. centers. The drills are placed across the rack at 9-in. centers. The capacity of the rack is sufficient to accommodate the output of the furnace for one hour. When the rack is full, it is possible to remove the drills from the first tier used and so provide continuous cooling space. It is most important for the drills to be clearly separated during cooling, and that the drills be cooled in still air.

12. Grinding and Inspection

After cooling the drills are taken from the cooling rack and the upset head ground to conform to the insert cutting angle of 110° C. The drill is then thoroughly inspected and given an identification brand on a flat ground on the shank collar. Such branding is carefully regulated and recorded in order to provide performance data for further development.

Results Prove Efficiency

1. Rock drills retipped and manufactured by the process described have proved equal in performance to any drills obtained from other suppliers, both Australian and overseas.

2. The cost of retipping at present, including all overheads, is approximately £1 ($2.80) per steel, plus the cost of the insert (approximately 30/-$4.20).

Rearrangement of the retipping process layout will reduce handling costs and increase efficiency at several points. As a result of these changes, it is expected that the total cost to produce a retipped steel will be reduced to 15/-($2.10) plus the cost of the insert.

3. On a basis of equal performance for retipped and first quality new imported drill steel, the use of retipped drill steel results in a 60% saving on drill steel costs while stocks of used drills are available.

4. It has been proved conclusively at the mine that the average piece of alloy drill steel has a fatigue life sufficient to outlast the second tungsten carbide insert.

Steel failures experienced with new drills average 3.6% of new steel purchased and our records show that steel failures in retipped drills amount to 3.9% of all steel retipped.

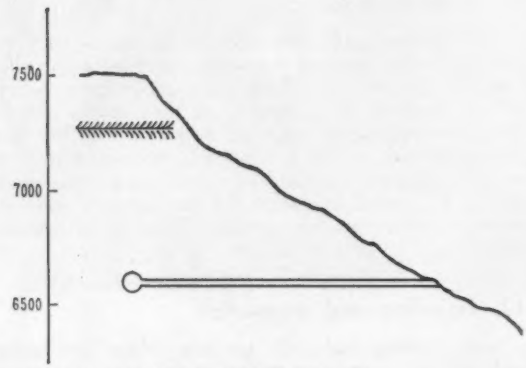
Excellent drills have been produced in large quantities by the techniques described in this article.

Independent laboratory tests carried out on bits processed at the mine show the shear strength of the braze to be 29,100 lb, whereas 23,000 lb shear strength is considered the minimum strength for a satisfactory braze for the application in question.

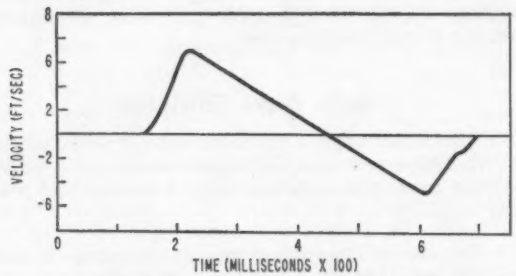
Careful selection of the grade of inserts purchased, has enabled the production of drills comparable in quality with any purchased from regular suppliers.

How to Predict the Effect of Spalling

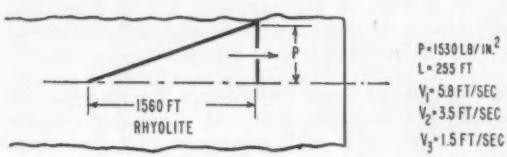
JOHN S. RINEHART

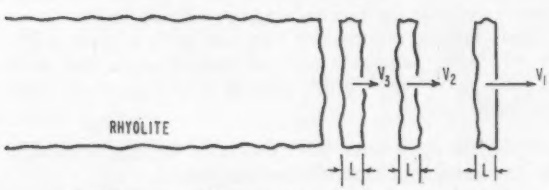


RAINIER SHOT LOCATION SCHEME



DISTURBANCE IN CONSOLIDATED TUFF—RAINIER SHOT





RAINIER WAVE APPROACHING FREE SURFACE OF RHYOLITE

THE RAINIER SHOT produced a sawtooth wave that broke the rhyolite 900 ft above the blast in a predictable manner.

SPALLING (SEPARATION OF ROCK) is important in the study of nuclear blasts. In this respect, theory can predict what will happen to the rock affected by the blast. In the case of the Rainier shot (E&MJ, April 1958) all of the observations made were entirely consistent with what can be predicted from an appreciation of spalling.

It was observed in the Rainier shot that one or more large slabs of consolidated tuff, or rhyolite, situated about 900 ft above the blast, as illustrated above, rose to a height of 9 in. and then fell. From these data and accelerometers placed in a vertical hole situated directly above the blast, it was possible to make a reasonable guess of the shape of the stress wave which reached this top layer of rock. The most probable curve is shown above. The leading portion of this curve approximates sawtooth waves whose actions will be discussed. The wave is redrawn above as a stress vs distance plot and shown approaching the free surface of the rhyolite. The specific gravity of the rhyolite was taken as 2.7. The maximum stress in the wave is 1500 lb/in.², corresponding to a maximum particle velocity of 7 ft/sec, if we take an average velocity for propagation of a wave of 6000 ft/sec, close to the measured value. Such a wave would produce three spalls of equal thicknesses in a material having a tensile strength of 500 lb/in.², a value reasonably close to that which might be expected for rock of this type. The three spalls would move away with initial velocities, 5.8 ft/sec, 3.5 ft/sec, and 1.5 ft/sec.

Gravity would slow these slabs down so that the total excursion of the top slab would be 7 to 9 in. Taking a somewhat lower tensile strength, say 250 lb/in.², several more, but thinner, slabs would be generated. The thickness of the consolidated tuff layer was 230 ft. It seems likely that the entire slab probably moved as a unit with additional spalling taking place in the material below. All of the observations made are entirely consistent with what can be predicted from an appreciation of the elements of spalling. The two most important parameters needed are the shape of the wave and the fracture strength of the rock. In most situations, the rock will be stratified so that it will come off in layers of thicknesses preselected by nature.

In considering the possibility of damage, it should be noted that the effect of gravity restricts substantially the movement of rock, primarily because the velocities involved are so low. Spalling produced on the walls and roofs of tunnels and other underground openings will not have the mollifying effects of gravity.

Propagation of Transient Disturbances

Large contained nuclear blasts impart tremendous forces to their immediate surroundings and these forces, becoming distributed in accordance with well-known laws of physics, produce damage in areas both near and remote from the blast. Many qualities of damage manifest themselves, and of these, one of the most esoteric is spalling—separation of rock—frequently close to a free surface, as a consequence of preferential partitioning of the momentum of the stress wave. The elemental principles of the dynamics and mechanics of spalling in soils and rocks are discussed here. These were the principles used to appreciate more fully the significance of the observations of ground movement at the Rainier blast.

When a buried nuclear bomb explodes, the action of

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When Caused by Large Blasts

the blast is not instantaneously transmitted to regions remote from the blast. Changing stress situations will be communicated through most materials at velocities of several thousand ft/sec, the exact value depending upon the material, the type of stress distribution, the state of stress within the medium, and the various boundaries involved. In large earth masses, velocities of two general types are encountered:

The dilatational velocity, C_l, the velocity of propagation of longitudinal waves in a medium of infinite extent, is given by

$$C_l = \sqrt{\frac{3K\,(1-P)}{D\,(1+P)}}$$

where K is the bulk modulus; D is the density of the material; and P is its Poisson's ratio. Variations of K, D and P with stress affect the value of C_l.

Shearing displacements advance through a material with a velocity given by C_t

$$C_t = \sqrt{\frac{G}{D}}$$

where G is the rigidity modulus.

If the stress level is exceedingly high, the material will behave as a fluid, having no rigidity, and transverse or shear waves cannot exist within it. Under these conditions, stress changes will be propagated with a velocity, C_f, given by

$$C_f = \sqrt{\frac{K}{D}}$$

The state of stress will affect both K and D. Indeed, at the exceedingly high pressures produced by nuclear blasts, changes in values of K and D can amount to 30 or 40%.

A stress disturbance passes through a body in the form of a transient wave of particle motions. A point or infinitesimally small particle within the body will be subjected to forces which impart transitory motions to it. The instantaneous velocity, V, of such a particle is directly related to the instantaneous stress S at that point by the equation $S = DCP$ where C is the velocity of propagation, viz., C_l, C_t or C_f, of the disturbance. Particle velocity in a longitudinal wave is parallel to the direction of propagation of the wave, moving along with an advancing compressional wave and opposite to an advancing tension wave. Particle motion within a transverse wave is normal to the direction of propagation of the wave. In a typical granite, a particle velocity of 3 ft/sec corresponds roughly to a stress of 1000 lb/in.²

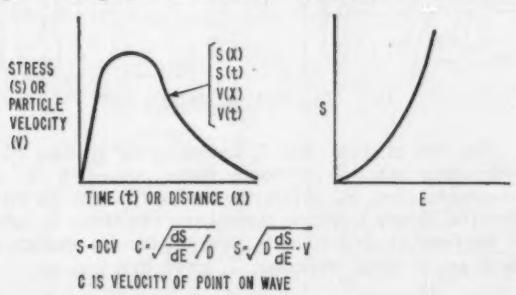

FIG.1 TYPICAL UNDERGROUND DISTURBANCE

A typical disturbance, such as might have been generated by an underground nuclear blast, is shown in Fig. 1. The particular parameters used in plotting the curve are selected for convenience. Note that there is a one-to-one correspondence between stress and particle velocity. Whether time or distance is used as the abscissa will depend upon whether the phenomenon is viewed at all points in space simultaneously or at a single point through which the disturbance is passing. The instantaneous velocity of propagation of any point on the wave depends upon the level of stress at that point, being given by the expression

$$C = \sqrt{\frac{\left(\frac{dS}{dE}\right)}{D}}$$

where (dS/dE) is the slope of the stress-strain curve at that stress level. Unless the stress-strain curve is linear, which is seldom the case, the different points on the disturbance will range in velocities. Thus the shape of the disturbance will be continually changing as it moves along. In the particular case shown in Fig. 1, the wave would tend to steepen its front since the higher stresses would be traveling at greater velocities than the lower stresses.

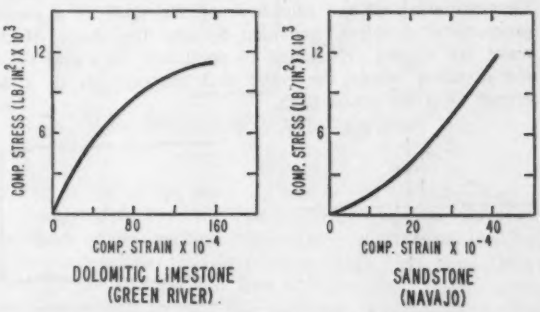

FIG. 2 STRESS-STRAIN CURVES FOR TYPICAL ROCKS

Rocks exhibit a wide variety of stress-strain curves. Typical curves for limestone and sandstone are shown in Fig. 2. Note that the limestone curve is concave downward, which means high stresses will travel at relatively low velocities. The sandstone is concave upward, implying that the high stresses will travel at high velocities. In limestone, the waves will tend to elongate and flatten out, with just the reverse being true in sandstone.

Dynamics of Spalling

Viewed simply, a material is said to spall when one segment of it parts and moves off from another segment. This will occur if the velocity of the one segment is greater than the velocity of the other, as illustrated in Fig. 3. Stress waves, on reaching a free surface and reflecting, are prone to give rise to this type of partition of velocity of momentum. Consider the semi-infinite body of Fig. 4, in which a stress wave of the shape shown is advancing toward a free surface. Assume, further, that the stress-strain curve is linear. When a disturbance strikes the free surface, it will be reflected as a tension wave without change in form. The incident compression

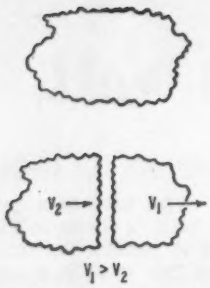

FIG. 3 DEFINITION OF SPALLING

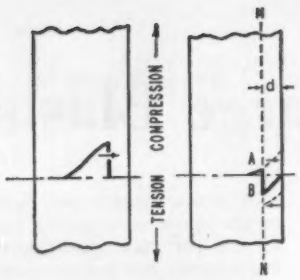

FIG. 4 STRESS WAVE IN A SEMI-INFINITE BODY

wave and its reflected tension counterpart will interfere with each other as indicated. The resultant distribution of stress within the body at a slightly later instant is shown in the right-hand drawing, the tension, AB, increasing as the reflected wave moves to the left. At some point, the material will no longer be able to support this tension; it will fracture; and a spall will fly off, trapping much of the momentum of the wave.

The stress required to rupture the material is called its critical normal fracture stress, S_c. In metals, this fracture stress is exceedingly high, corresponding to differential particle velocities of 100 to 200 ft/sec. In rocks, the stress is quite low, being in the neighborhood of 500 lb/in.^{2} (1 to 2 ft/sec particle velocity for granite). The critical normal fracture stress is an extremely important mechanical property of the material and is the factor which governs parting of the material. Note that two factors are important in describing spalling: the shape of the stress wave, and the critical normal fracture stress. Determination of the thickness of the spall is a simple geometrical problem, provided S_c and the shape of the wave are known. Thickness of spall will be equal to ½ the distance within the wave that corresponds to a decrease in stress equal to S_c.

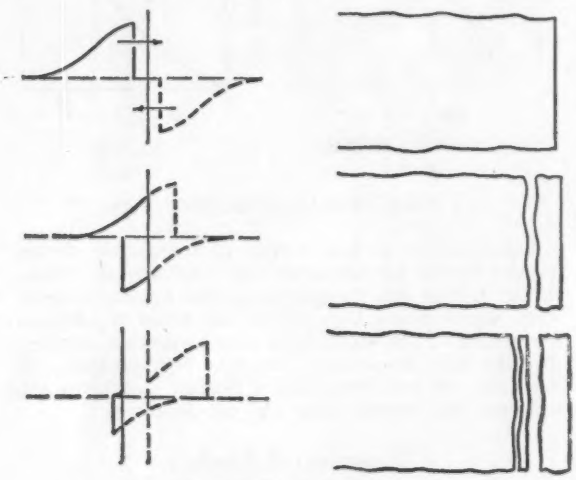

FIG. 5 MULTIPLE SPALLING

Multiple spalling occurs when the stress level within the wave is more than double the critical normal fracture stress of the material. In such cases, several juxtaposed and parallel spalls are generated, as illustrated in Fig. 5. These arise in the following way. Assume that the first spall is generated in the manner just described. The remainder of the wave will suddenly find itself impinging on a freshly created, free boundary surface. The result will be the formation of another spall. This process will repeat itself until the stress level of the wave has been reduced to a value less than S_c. In the case illustrated, the thicknesses of the two spalls are vastly different. The first spall is quite thick because the leading portion of the wave is relatively flat. The subsequent abrupt decrease in stress thins down the second spall.

As pointed out earlier, underground blasts can give rise to disturbances of a wide variety of shapes which continually change as they propagate. Four idealized

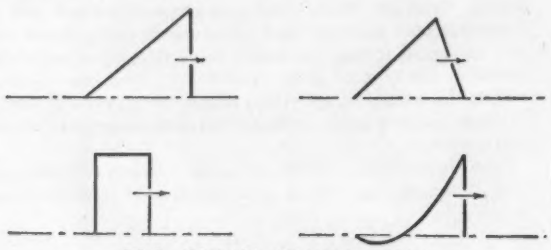

FIG. 6 IDEALIZED DISTURBANCE SHAPES

shapes are illustrated in Fig. 6. In view of the strong dependence that the thickness of the spall has upon shape of disturbance, it is apparent that each particular shape of disturbance generates its own characteristic spalls. Given the shape of the wave and the fracture stress of the material, it is, of course, possible to describe precisely the character of these spalls. The simplest shape to consider is the sawtooth curve in the upper left-hand corner of Fig. 6. This shape does not differ appreciably from that of the disturbance produced in the consolidated tuff 900 ft from the Rainier shot. (See drawing at beginning of article.)

Influence of Material Properties on Spalls

The tensile strengths, compressive strengths, competencies and anisotropies in mechanical properties range widely in rocks and soils. The foregoing section described spalling for the very particular situation where the rock is perfectly elastic and isotropic. It was also tacitly implied that the material could support a compressive stress greater in magnitude than the tensile stress it could support. In real situations, such an ideal circumstance will not occur. Compare now the three differing situations shown in Figs. 7, 8 and 10.

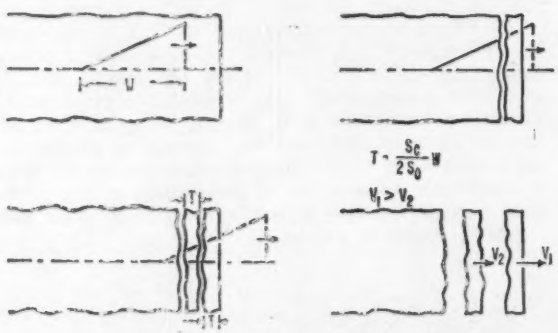

FIG. 7 SPALLING FROM SAWTOOTH WAVE

The first of these, Fig. 7, illustrates the spalling which will occur when a sawtooth wave, of length W and maximum stress S_o, strikes the free surface of an elastic material having a critical normal fracture stress S_c, which is between ½ and ⅓ of S_o. Two spalls are thrown off. Both are of equal thickness, T, given by

$$T = \frac{S_c}{2S_o} W$$

but of different velocities, the piece to the right having the highest velocity. Specifically, the two velocities, V_1 and V_2, are

$$V_1 = 2V_o - \frac{S_o}{DC} \; ; \; V_2 = 2V_o - 3\frac{S_o}{DC}$$

As the detached spalls move to the right they will become separated by an amount which is easily calculable using the above equations.

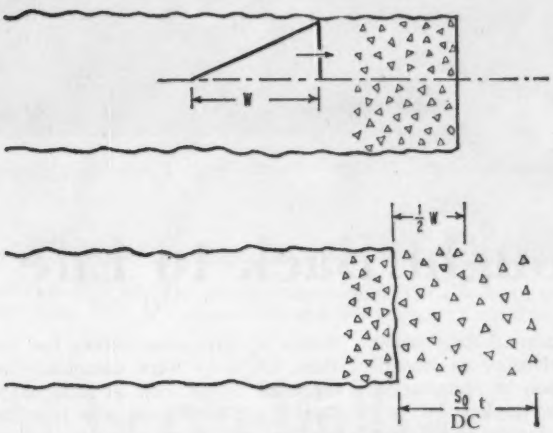

FIG.8 FLAKING IN INCOMPETENT MATERIAL

What will happen under similar circumstances when the material is incompetent, incapable of supporting any tension whatsoever, is illustrated in Fig. 8. It is assumed, however, that a compressional wave will be transmitted without change in form. As soon as the wave reaches the free surface, the material will begin to flake off. The velocities of these first flakes will be equal to $2V_o$ where V_o is given by

$$V_o = \frac{S_o}{DC}$$

Each bit of flaking absorbs a small portion of the momentum of the incident wave. The remaining portion of the incident wave will continue to advance against the freshly-created free surface, flaking continuing so long as any portion of the wave remains. The velocity, V_p, of any small particle will be given by

$$V_p = \frac{S}{DC}$$

where S is the value of the stress at the front of the incident wave at the time the particle leaves the surface. The initial thickness of the flaked-off material will be ½ W. The flakes themselves will appear as a cloud of debris, the rear portion of which is stationary and the front moving forward with a velocity $2V_o$. Thus the extent of the cloud of debris is continually increasing, its forward portion becoming less dense.

The situation for incompetent rock or soil is examined in a little more detail in Fig. 9. Here are compared the displacements of points within a competent, elastic solid which does not spall and an incompetent mass which flakes off. Note that in the competent solid, the two points, A and B, eventually undergo the same displacement but do not do so simultaneously. The reason their total displacements are the same is simply that the material does not fly apart, and such must therefore be the case. The incompetent material behaves differently. Point A initially acquires a velocity which is maintained so that A moves farther and farther away from C; B moves along at a somewhat lower velocity. If the free surface of such a mass were horizontal, the restraining force of gravity would affect the material so that it would be brought to rest. These two drawings illustrate graphically the primary reason why damage is so much greater in unconsolidated soils and unconsolidated material than in solid rock.

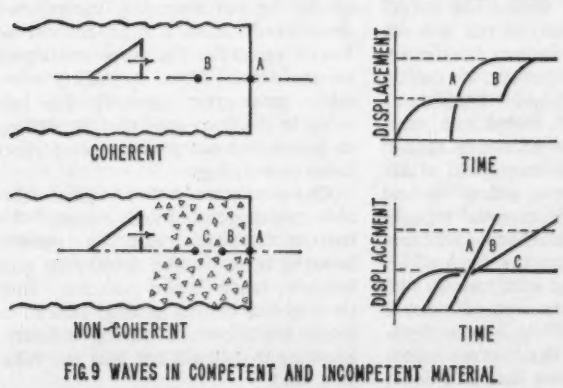

FIG.9 WAVES IN COMPETENT AND INCOMPETENT MATERIAL

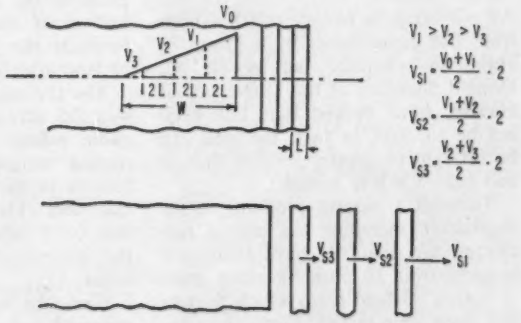

FIG.10 WAVE ACTION ON JUXTAPOSED SLABS

The action of the wave on a series of juxtaposed slabs is illustrated in Fig. 10. The joints between the slabs are assumed to be perfect transmitters of compression but possessing no strength in tension. Each slab is of thickness L. On striking the free surface, the incident wave will be reflected, with the reflected portion proceeding backward (into the left) into the rightmost slab. When the wave reaches the first joint, the rightmost slab will fly off, trapping in it the momentum in the wave back to a distance 2L. The velocity of this slab, V_{s1}, will be

$$V_{s1} = V_o + V_1$$

The second slab will then be carried off in a similar fashion with a velocity given by

$$V_{s2} = V_1 + V_2$$

and finally, the third slab with a velocity

$$V_{s3} = V_2 + V_3$$

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LOW FOREGROUND HILLS typify bauxite-rich lands on Kauai. In test plot at right, different forage grasses are compared.

Mined-out Land Brought Back to Life

"STRIP MINING KILLS THE LAND!" All too often in history this has been true. But experiments by a group of Hawaiian scientists, led by Dr. G. Donald Sherman of the University of Hawaii, have proved that this need not be so; that, in fact, the land can be brought to greater fertility than it had before it was mined.

Through a careful program of re-vegetation, including the use of fertilizers, the scientists have been able to grow over 10 times as much grass as before on land from which bauxite had been strip-mined. From their researches, the State of Hawaii has drafted a strip-mining law which will allow development of the islands' mineral resources without ruining their precious resources of land.

Hawaii's bauxite deposits are not commercial now, because they are too low in grade and are far from processing plants. But they do represent a large potential resource for the United States, and the basis of a possible alumina industry in the future.

Deposits containing over 500-million tons of alumina extend over 330 sq miles of high-rainfall land on Kauai, Maui and Hawaii; occurring in surface formations, they range in depth from 10 to 30 ft. But average ore grade is only 20-40% Al_2O_3. Still, the deposits have been interesting enough that several aluminum mining companies have explored them.

Looking toward the future, the Hawaiian government foresaw the possibility of a bauxite mining industry; it also foresaw the possibility of damage to the land. Land, to Hawaiians, represents their most precious resource. Wanting above all to preserve it, but at the same time to encourage a mining industry if possible, the Legislature made a $50,000 grant to the Agricultural Experiment Station of the University of Hawaii to study the problem of reclamation of land after bauxite mining.

The site selected for the experiment was 5½ acres, situated in the Wailua game refuge on Kauai. A bauxite mining company had designated the bauxite in the area as good commercial ore. The average composition was 0.7% silica, 40% alumina, and the balance chiefly iron oxide and water.

First, the surface foot of soil was removed and stockpiled. Then the ore was stripped off down to the subsoil, which consisted of weathered basalt boulders. The lower boundary of ore was determined by rapid tests for kaolin clay. Eighty-six thousand short tons of ore containing 35,000 short tons of alumina were removed, to an average depth of 11 ft. The exposed subsoil surface was then plowed and disked to give a friable seed bed. One-half of it was covered with topsoil, to its original depth of about a foot. The other half was left bare.

The ore was considered non-commercial where the silica content was higher than 6% and the alkali-soluble alumina fell below 30%. The cut-off point of the commercial ore was obvious even to the laymen by the appearance and frequency of certain types of weathered basalt boulders.

The tests, which lasted one year, showed that it was necessary to add fertilizer to get any crop yield at all. Nitrogen, phosphorus, potassium and magnesium were the essential ingredients of the fertilizers. Their cost came to $155 per acre on the land which had been re-covered with topsoil, and $245 on the directly-exposed subsoil.

But once the soil had been fertilized, it produced much more vigorously than the original land had done. Within 90 days after mining had finished, all areas were completely re-vegetated. Some took as little as 30 days. Much more grass grew from the fertilized soils than had grown before. The land originally had been poor grazing land, much like that of other bauxite areas; it would carry about one head of cattle per 10 acres, and produce from 10 to 30 lb of beef per acre per year. The most productive "new" land yielded enough grass to produce from 500 to 600 lb of beef per acre-year. That's a whole one-third of a cow, in place of two or three fair-sized roasts.

The directly-exposed subsoil produced higher yields than did the removed-and-replaced topsoil. A great variety of plants could be grown in the mined-out-and-fertilized soils. The best was a grass-legume mixture; pineapples and sugar cane grew satisfactorily; so did sweet potatoes, guava, passion fruit and corn. Vigorously-growing eucalyptus trees achieved as much as a foot a month. The success of the re-vegetation allayed two fears of the Hawaiians: soil erosion and loss of watershed.

If the bauxite ores were to be upgraded by wet screening, the rejected fines would have a high content of kaolin minerals. On plots containing rejected fines from upgrading tests, sudan grass grew copiously. The layering in the fines produced by settling in ponds did not prevent plant roots from penetrating.

One year's study thus yielded valuable conclusions. Land denuded by bauxite stripping can be quickly brought back to life; it may in fact become much more valuable land than it was before mining. Hawaii is ready for a bauxite mining industry, knowing that it will not hurt the valuable land.

REVERSE OPEN PIT mining causes unusual tire and brake wear on loaded trucks that move down 8% grade. Additional problems are created by dust, mud, and fog.

At Cerro Bolivar Truck Care Is Vital

MINING ON CERRO BOLIVAR, as well as on nearby Altamira and Toribio, is open pit mining reversed. The ore is on top, the hill mass underneath, and the transportation movement is downhill with load. Operations are on a three-shift basis, twelve months a year.

Cerro Bolivar is 7½ miles long and 2½ miles wide. Its highest point rises approximately 1,800 ft above the surrounding savanna to an elevation of 2,605 ft above sea level. The ore is encrusted on the top and upper slopes of the hill.

Although much of the mineral is loaded directly into trains, a large part is loaded first into heavy-duty trucks and then transported to the trains for the 90-mile run from the mine to Puerto Ordaz. At Puerto Ordaz the ore is shipped to various parts of the world, chiefly to the United States, England, Germany and Italy. Orinoco's production, most of it taken from the Cerro Bolivar mine, exceeded 14-million metric tons in 1959.

The bulk of the ore tonnage on Cerro Bolivar is above the railroad assembly yard, hence truck and locomotive special braking capacity and action is necessary. Six electric shovels, with either 8 or 9 cu yd dippers, and one 6 cu yd diesel shovel, operate in separate areas on 15 m (49.2 ft) benches throughout the length of the orebody. The shovels load the ore directly into ore cars, or into ore trucks, which in turn dump into the railroad ore cars from loading ramps.

The present force of 35 Mack trucks is being supplemented by seven new 50-ton units. The greater truck capacity will enable the loading of a railroad car with only two truck loads, instead of the usual three.

If we consider that this is a mountain type of operation and that the trucks are operating at an altitude of over 1,900 ft above sea level, and running downhill under loads, it is evident and easy to understand that braking action is of paramount importance. The truck specifications call for a vehicle which, among other requirements, will go down an 8% grade loaded, at any speed below 20 mph, under the control of an auxiliary retarding device, independent and in addition to the standard hydraulic wheel air-braking system. This is a fundamental requirement for operations on Cerro Bolivar because inadequate or defective braking systems might cause accidents.

Bearing this in mind, Orinoco Mining Co. has spared no effort to install a first class repair, maintenance and mechanical shop right on Cerro Bolivar where the mining operations take place. The shop is equipped with modern machines which are manned by trained personnel. The efficiency of this shop has reached a point where practically any machine part can be repaired, replaced and in some cases even rebuilt. Certain men are assigned to work on trucks alone.

Servicing of the trucks may be divided into five operations: 1) general servicing; 2) the 6,400-hr inspection and complete overhauling; 3) 4,000-hr inspection; 4) on-the-field inspection and on-the-spot repairs; and 5) afternoon and night repairs and checking of braking systems.

Tires Have Short Life

During the dry season, that is from November until March, special water tank trucks are constantly spraying the ore-hauling operation areas in an effort to lessen wear-and-tear effects on the engines and parts produced by iron ore dust and particles. Apart from the fact that these units are operating in rough terrain, at high altitudes, under permanent pressure, it is easy to visualize the "punishment" taken by the trucks as the 9-cu-yd bucket of the Bucyrus-Erie electric shovels releases its load of approximately 15 tons of iron ore, from a height of 4 or 5 ft, on the trucks that line up along the bench. Another significant detail helps complete the picture: tires last only an average of 1,000 to 1,500 working hours, after which they must be recapped.

Then again, the rainy season, from April until October (the area has an average annual rainfall of 75 in.), brings with it the usual problems of rain and mud, which are made even worse by the heavy night fogs on Cerro Bolivar during certain times of year. Each of the 35 trucks is equipped with a special backup warning signal. It consists of a high-pitch intermittent whistle that is set on automatically as soon as the driver shifts to reverse. This special warning device, in addition to the bright spotlights that illuminate the loading dock and the indicators that are lined along the edge of the benches, has contributed to the prevention of accidents. Without these precautions a truck backing-up in dense fog could possibly injure a worker, crash into another truck or go over a bench for a drop of anywhere from 50 to over 1,000 ft.

The care, ability and talent with which a driver handles his unit are all factors that affect the longevity of the machine and its parts. Training the drivers has been a major consideration for Orinoco Mining Co. Seventy-five per cent of them have been trained at the mine itself. Many had had no previous experience whatsoever. It has been estimated that it takes one year to train a man for this type of operation.

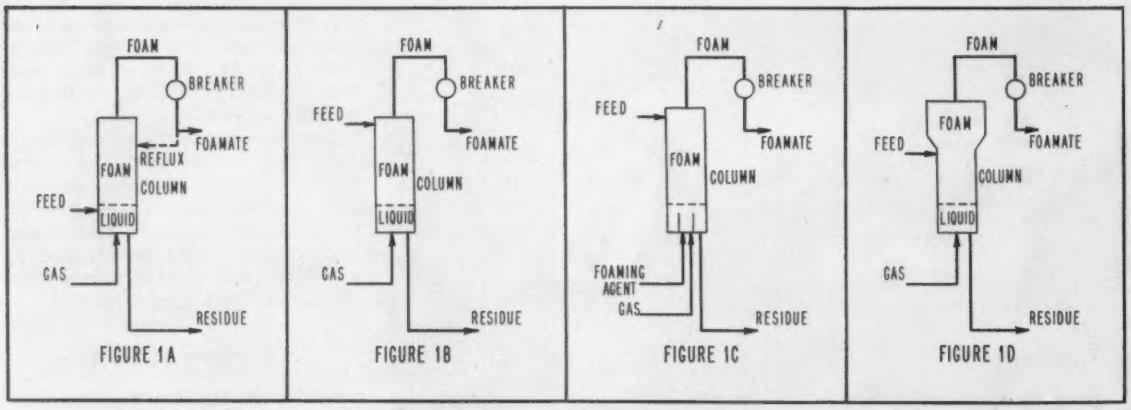

Fig. 1. Stages in development of a continuous-foaming column. 1a, continuous addition of feed, containing the foaming agent, directly to liquid pool in column. Also, same system modified for reflux (dotted line), some of condensed foam being returned to top of foam column; this arrangement gave high foam concentrations, but failed to decontaminate residue satisfactorily. **1b,** continuous liquid feed to top of foam column, i.e., a stripping column. This system gives high single-column decontaminations (200 in some cases), and is basic configuration used in all subsequent work. **1c,** "split-feeding," with only a portion of foaming agent added directly to feed, and rest supplied directly to foaming chamber; this gave higher decontaminations, and generally improved performance, but much foaming agent went out with residue. Also, a modification in which foaming chamber was divided into a central "foaming" zone, where foaming agent and gas are introduced and bubbles formed, and a surrounding "bulk" region, from which residue is drawn; this gives high decontamination without excessive loss of foaming agent in residue. **1d,** an expanded head section (above feed point) may be added to provide for better foam drainage and thus achieve greater volume reduction. By combining modified "split-feed" and expanded-head arrangements, one can make a single column that will give decontamination factors of 500-600, and volume reductions up to 100-fold.

New Separation Method, 'Foamet,' Makes Progress

FOAM FRACTIONATION, or "Foamet," is a new metal ion separation technique that may have a bright future, although it is now definitely still a baby and seems to have limitations as well as potentialities.

This is a process for concentrating metals in solution. It can be used for: 1) Recovering metals from dilute streams, either to decontaminate the streams or to recover values; 2) Purifying solutions that contain metallic impurities; 3) Extractive metallurgy and refining.

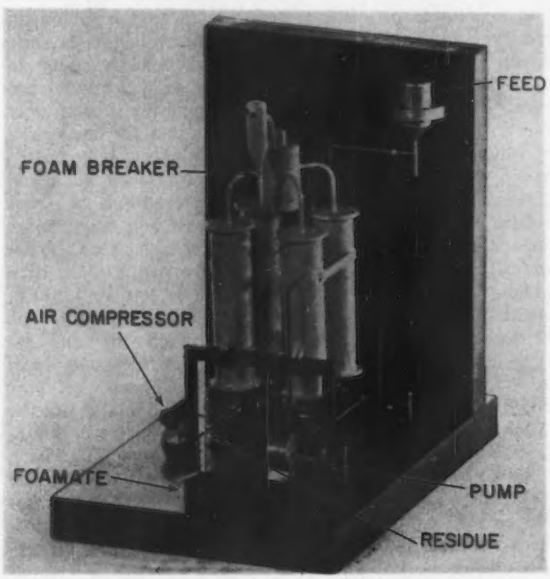

Fig. 2. Laboratory foaming-separation unit resulted from multi-column experiments.

Here is basically how it works. When a solution containing surface-active solutes (salts) is exposed to a gas, the solutes tend to migrate to the gas-liquid surface. Therefore, the surface layer is richer in the solute than the bulk of the liquid.

If a gas is bubbled through such a solution, and causes it to foam, it creates a large amount of "surface." Collecting the foam will yield a concentrate richer in the desired solute than is the bulk liquid.

This seems a lot like flotation, and, physically, it is. But in principle and application, it is different. Foam separation works best in quite dilute solutions; its effectiveness decreases as solutions get more concentrated. With flotation, the reverse is true. Foaming works on ions in solution, like salt in salt water; whereas flotation works with suspensions of solid particles in a liquid. Chemically speaking, a flotation system has at least three phases: a gas, a liquid, and at least one solid; but a foaming system has only two—a gas and a liquid.

Until recently, only naturally surface-active substances—complex organic molecules, like dyes, fatty acids, proteins and enzymes—could be separated by foaming. Most metal ions are not naturally surface-active. But a little over two years ago, people discovered that foaming could concentrate inorganic solutes, like metals.

US RUBBER ROYALASTIC TAPE

ROYALASTIC TAPE DOES TWO JOBS

It does the work of both rubber and friction tape.

- Complete mechanical and electrical protection.
- Good tensile strength and high resistance to abrasion and to water, oils, acids, alkalies and corrosive chemicals.
- Good stretch and easy to handle. Makes a neat, thin splice. Approved by Underwriters' Laboratories, Inc.

• • •

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Mechanical Goods Division

United States Rubber

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How? By causing the metal ion to complex with another ion, so that the resulting complex ion was surface-active. To achieve this, one had to add a suitable "foaming agent" to the solution.

Like all processes, foam separation has its own range, and limits, of applicability. Because the process is in its infancy, the limits have not yet been sharply defined.

Foaming is considered most effective in dilute solutions, about 10^{-4} molar and below. Tests have pushed the upper limit up somewhat; enrichment has been reported for strontium solutions as strong as $5x10^{-2}$ molar. Interference from unwanted ions can be a problem; early work on strontium showed that enrichment depended on total alkaline-earth concentration (calcium, magnesium, barium, strontium, etc.), not on strontium alone. The pH of the solution is a factor. Best approach has proved to be to select a foaming agent that works well in the pH region of the feed solution.

Particular foaming agents have been developed that are specific for certain compounds or groups; some have been developed that work well in certain pH ranges, and so forth.

There has been more work on strontium separation than on any other system. Radiation Applications Inc. of Long Island City, N.Y., who developed the "foamet" process, undertook in 1957 to find a way to remove strontium and cesium from nuclear process wastes; the AEC sponsored the work. Their strontium work has progressed furthest.

One of the main tasks was to develop an effective continuous-foaming column. The four sketches in Fig. 1 illustrate their progress. Using four columns in series, they have gotten decontaminations of over 10^{10} between primary feed and final residue, with foaming agent economy that is claimed to be excellent. A practical foam-separation unit that RAI designed from their column experiments is shown in Fig. 2. It will remove strontium and cesium from 10 gal/hr of neutral wastes, with decontamination factors of 10^8 (minimum) for strontium; and it can handle a greater throughput, if lower decontamination is acceptable. Columns are arranged around a central foam-breaking-and-condensing unit; and more, or fewer, stages may be added as desired.

Four scientists, two from RAI and two from Columbia University, have discussed foam separation and reported their experiments with it (Schnepf, Gaden, Mirocznik & Schonfeld, "Foam Fractionation: Metals," CHEMICAL ENGINEERING PROGRESS, May 1959, pp 42-46).

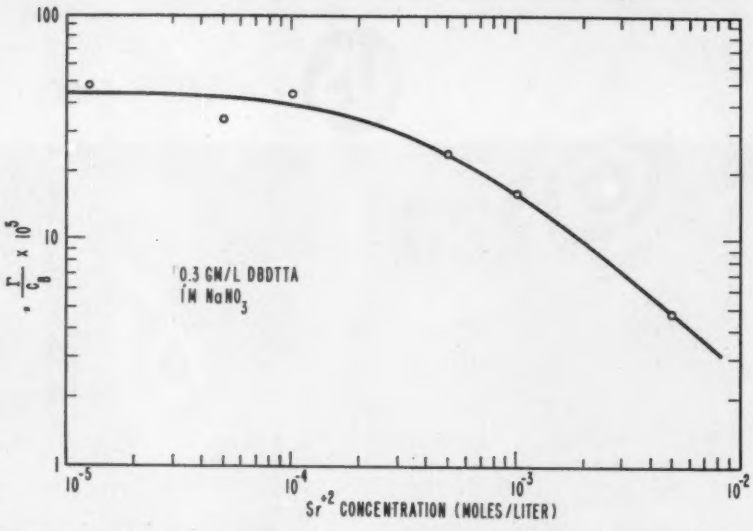


Fig. 3. Variation of surface (foam) concentration with strontium concentration.

Among the foaming agents that these scientists tested, which gave varying degrees of success, were: aromatic sulphonates, of which Areskap 100 is an example; fatty acids, e.g. sodium oleate; simple amino acids, e.g. lauryl-alanine; polypeptides, e.g. Maypon K; aminopolycarboxylic acids, e.g. Deriphat 160; and polyamino polycarboxylic acids, e.g. N-dodecyl benzyl diethylene triamino triacetic acid.

Based on work by RAI, Fig. 3 shows how enrichment increases as solution concentration decreases. Abscissas here are strontium concentrations, in moles per liter, in the bulk liquid; ordinates are the parameter Γ/C_B, which is equal to $\frac{1}{a}\left(\frac{C_F}{C_B} - 1\right)$, and is roughly a measure of enrichment. Γ here is Gibbs surface excess; C_F is concentration of the condensed foam; C_B is concentration of the residual liquid; and a is the area which unit volume of condensed foam would have if stretched to the thickness of the foam bubble film. This parameter is used rather than the simple ratio C_F/C_B, because the latter varies considerably with experimental conditions such as bubble size, gas rate and column geometry.

PERSONALS

P. Robert Palmer was recently elected president of American Shale & Petroleum Co. to succeed **Anson S. Blake,** who died last year. **Chester J. Wolf** and **Philip G. Markwart** were elected new directors.

Alvin O. Johnson has been named superinendent of field engineering for Oliver Iron Mining Div., U.S. Steel Corp.

F. B. Wercinski, assistant superintendent of White Pine Copper's smelting and refining department has been promoted to superintendent.

T. F. Olson has joined the Eimco organization in the newly-created position of financial vice president.

Wayne L. Dowdey, general sales manager, has been elected a vice president as was **Dr. Don Dahlstrom,** director of Eimco's Research & Development Center.

Three new directors were elected by the Wyoming Mining Assn. at its fifth annual convention. Four others were reelected.

New directors are: **V. O. Murray,** Union Pacific Coal Co.; **A. W. Runge,** Susquehanna-Western; and **E. L. Stout,** Intermountain Chemical Div., Food Machinery Corp.

Reelected were: **A. V. Quine,** Lucky Mc Uranium Co.; **Harry Thorson,** Wyoming Bentonite; **Glenn E. Sorensen,** Kemmerer Coal Co.; and **Veryl Hoover,** Pacific Power & Light Co.

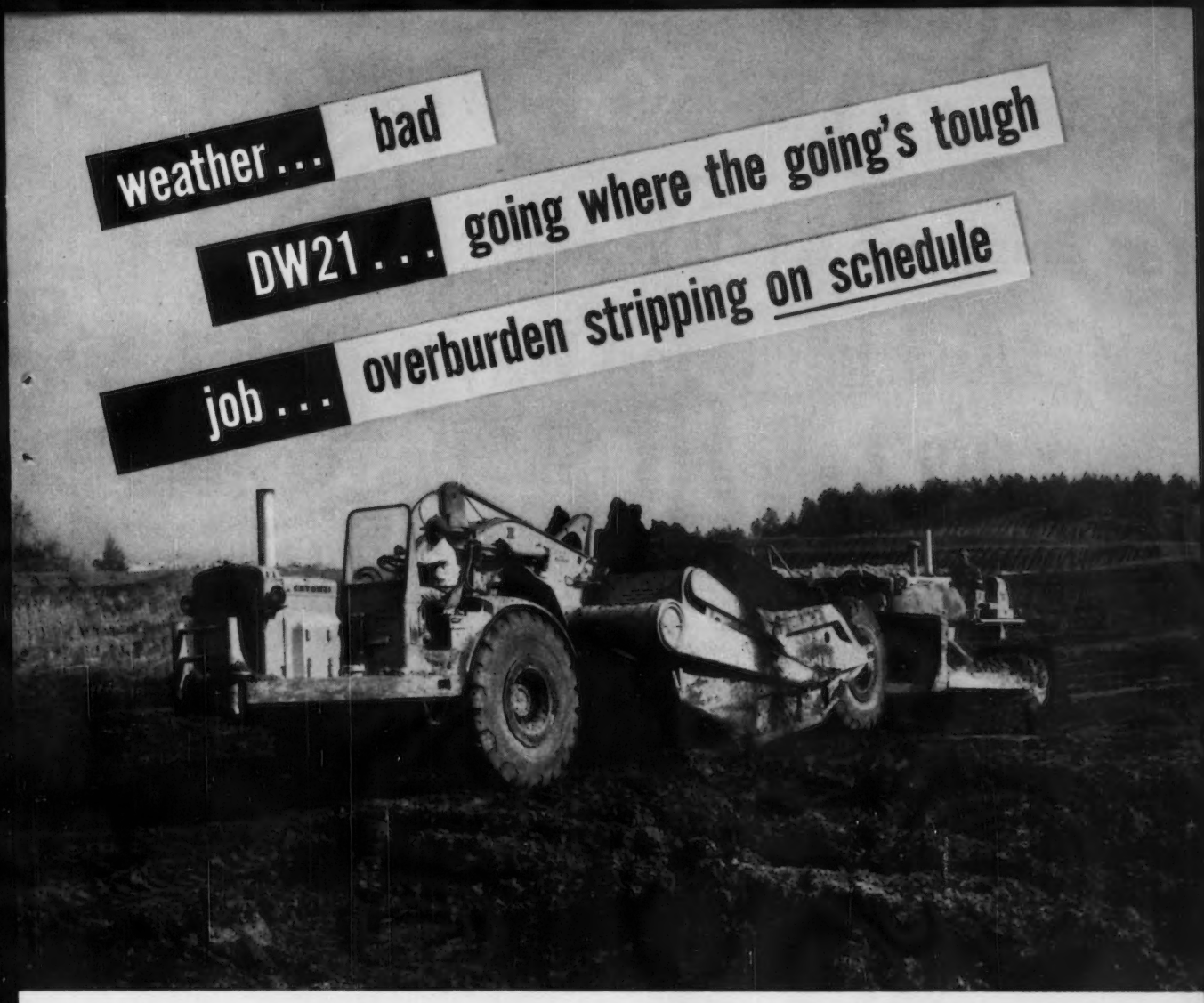
Thomas E. Ban has been elected vice president-research of McDowell Co. Inc. to direct operations of the Dwight-Lloyd Research Laboratories.

Eugene N. Hogan, labor commissioner for the Anaconda Co., retired July 1 after a career of nearly 50 years in the mining industry.

Daniel P. Griffin, personnel director for Butte operations, has assumed Hogan's duties.

Walter Swanson has succeeded **Carl Lundwall,** retired, as master mechanic at Hanna Co.'s Hiawatha Mine. **Lester Winton** and **Manch Applin** have been advanced to maintenance foremen at the Wauseca and Hiawatha Mines.

(Continued on p. 112)



Job—1,200,000 yards of clay, sand and lignite to be moved in 6 months. Working 12 miles southwest of Little Rock, Arkansas, Dulin & Co., Inc. stripped overburden 55′ deep for a bauxite mine. Heavy rains made haul roads slippery . . . load and dump areas mucky.

But the job was completed on schedule. Five DW21s and 470B Scrapers moved 10,000 cu. yd. per 20-hour day. They carried 16 bank cu. yd. on a 3600′ cycle.

Here's what Superintendent Clyde Moore has to say about the DW21s: "We're a 100% Cat-equipped company. The new DW21 is the best hauler we've ever used. It's got lots of speed and traction. It goes through mud that's tough for track-type tractors."

This is the kind of performance you can expect from the new DW21G. Its 345 HP diesel delivers 12% more rimpull which provides up to 20% faster speeds than the former models over similar haul conditions. To handle this increased horsepower, the DW21 has stronger final drive gears and improved transmission shifter forks. The matching 470B LOWBOWL Scraper has greater capacity . . . 19.5 cu. yd. struck . . . 27 cu. yd. heaped. Stronger bowl, draft frame and apron result in longer service life, less maintenance.

The new DW21 is geared for today's highly competitive market. It's a high-capacity rig designed to move more dirt at a lower cost.

Pick your toughest job. Then pick up your phone and call your Caterpillar Dealer. Ask him to demonstrate the heavy-duty, profit-making DW21.

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

CATERPILLAR

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WANTED—THE HARD WORK

Employee Gift Matching

Another Good Way To Help Our Colleges And Universities

The business community continues to make an impressive record in giving badly needed financial help to our colleges and universities. This year the Council for Financial Aid to Education expects that business contributions to higher education will be well over four times their total of about $40 million a decade ago.

If these contributions, which were about $150 million last year, continue to increase at the present rate, they will hit the target of $500 million set for business aid to our colleges and universities in 1970. This is the amount which, the Council calculates, must come from business if these institutions are to have the money to do their job properly a decade hence.

However, it would be a fine thing both for the nation and the business community if that $500 million dollar target were hit well before 1970. This would put us ahead of a schedule (it is a conservative schedule) in getting on top of what remains one of the nation's most crucial problems—that of having its colleges and universities adequately financed which they are very far from being right now.

There is, we believe, one quite simple way by which financial support for higher education by business firms might be considerably speeded up. All that is required is that business firms generally abandon the idea that it is possible for every company to have a program to provide such support that is novel and distinctive, and that this is the only way that interests of prestige and good public relations can be served.

There are nowhere near enough good plans to provide financial help for higher education to equip even a small percentage of our business firms with one that is novel and distinctive. Also **there are a number of very good plans which, so far as we can tell, lose nothing of their value for prestige and good public relations by being used by a large number of companies.**

The Gift Matching Idea

One plan with these attractive characteristics is the plan by which companies match the gifts of their employees to colleges and universities, and now increasingly gifts to independent secondary schools. So far as we can discover the general plan was invented by the General Electric Company, with what it calls its Corporate Alumnus Program. Now, with variations on the same basic design, almost 100 companies have gift matching plans. We at McGraw-Hill are included in this number.

The gift matching plans vary considerably in detail. Some are limited to alumni of the schools to be benefited. In others any employee can participate by making a gift to an eligible institution. There are also variations in the maximum amounts of gifts by individuals and to individual institutions which will be matched. Some companies have "open end" plans; others limit the total to be matched in any one year. All of the plans, however, embody the same central gift matching idea.

When the plan was first launched some college administrators of little faith in the fundamental generosity of the alumni and friends of their schools expressed the fear that if gifts were to be matched they might be made smaller in the first place. The opposing view was that the possibility of having them matched would stimulate more and larger gifts.

Advantages Of Gift Matching

So far as we have been able to discover, the expectation that giving would be stimulated by gift matching has been validated by the experience with the plans. This has been our experience at McGraw-Hill. Some other important virtues of the gift matching programs have been summarized by

LEADERS OF SOME OF THE INSTITUTIONS WHICH HAVE SHARED IN THE McGRAW-HILL EMPLOYEE GIFT MATCHING PROGRAM EXPRESS THEIR VIEWS

"We particularly appreciate the fact that your grant is unrestricted, and can therefore be used for our area of greatest continuing need — the General Education Fund, from which faculty salaries come."

W. Boyd Alexander, Vice President and Dean of the Faculty
Antioch College

"We are grateful, not only for the financial support given to The Cooper Union by your company, but also for the stimulus it has provided our alumni in your employ to make annual gifts to their Alma Mater."

Edwin S. Burdell, President
The Cooper Union

"The gift matching program has a dual advantage. First, it acknowledges and repays a debt of honor to those colleges which, often at great loss to themselves, have trained and educated the men who are now among your personnel. This is most fair and equitable. Secondly, by offering to match up to a given limit the contributions of alumni, you encourage support of their own colleges on the part of graduates, who themselves are so indebted."

President Edward B. Bunn, S. J.
Georgetown University

"Thanks to your doubling of the annual gifts of one of our generous and loyal friends who works with you at McGraw-Hill, we are well on the way toward creating what for us will be an extremely helpful scholarship fund. This would not have been possible without the gift matching program."

C. Adrian Heaton, President
California Baptist Theological Seminary

Ernest T. Stewart, Executive Director of the American Alumni Council (1785 Massachusetts Avenue, N.W., Washington, D.C.) who would be glad to provide detailed information about them, and the names of companies having such plans. Of the gift matching idea he says,

> "*First*—it assures the corporation that its gifts go direct to those colleges and universities which have furnished it with trained manpower.
>
> "*Second*—it places responsibilities for the gifts on the institutions themselves and drives home the point that they must make a real effort with their own alumni.
>
> "*Third*—it leaves the final decision of corporate support basically to the employees."

For many companies which are fearful of complicating their relations with their customers by courting charges of favoritism if they provide direct financial support for any particular school or group of schools, this latter consideration can be of decisive importance.

The gift matching plan also has what for many companies is the very important virtue of being simply and easily administered. Some additional virtues of the gift matching plan, as seen by officers of institutions which have been beneficiaries, are indicated in the box at the top of this page.

Effective And Easily Managed

We at McGraw-Hill are well pleased with our gift matching program. It is a broad program in which all employees and a wide array of colleges and universities, both privately and publicly supported, are eligible to participate. We commend it as an effective and easily managed plan to provide urgently needed financial aid to higher education.

We also urge that business firms adopt this or one of a number of other very good programs of financial aid to higher education* rather than delay in the hope of hitting upon some quite new and distinctive plan. There are very long odds that such delay will prove unavailing. In the meantime our colleges will be losing financial help which it is profoundly in the interest of the business community and the nation to see that they get—and get fast.

---

*An earlier editorial in this series dealt with tuition supplements as another good way to help our colleges and universities. Reprints of this editorial are available. So are copies of a "more or less socratic dialog," entitled, **A Business Wrestling with the Problem of Aid to Colleges and Universities.** It was prompted by the efforts of McGraw-Hill to find suitable methods of providing financial aid to higher education.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nation-wide developments. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw
PRESIDENT
McGRAW-HILL PUBLISHING COMPANY, INC.

PERSONALS (*Continued*)

A. G. Kirkland has been named president of Brown & Root Ltd., newly-established Canadian subsidiary of Brown & Root Corp. Inc.

Kirkland had been general manager of Howe Sound Co.'s mines at Salt Lake City since 1957.

Gunter J. Bilstein, former air tool specialist with Cook Bros., Oakland, Calif., is now a mining consultant with Philipp Bros. Ore Corp.'s Peruvian Minerco office.

Joseph T. Hall, president, Callahan Mining Corp., has been appointed a director of the Bunker Hill Co.

Hall has more than 25 years of mining experience and served with San Juan Metals Corp. and Sunshine Mining Corp. before joining Callahan in 1936. He was elected president in 1945.

W. E. R. Smith is the newly-elected vice president of American Zinc Co. of Illinois.

Smith joined American Zinc in 1937. Since 1941 he has been at the Dumas, Tex., plant where he has served as director of personnel, business manager and resident manager. He will continue to serve in the latter capacity.

Glen A. Boyd, mining geologist for the Northern Pacific Railway, has been appointed district mining geologist in charge of NP's geology division activities in Washington, Oregon and Idaho.

Patrick E. Cavanagh has been appointed president of Premium Iron Ores Ltd., Montreal-based firm associated with Steep Rock Iron Mines and other Cyrus Eaton interests.

R. E. Kendall has filled the newly-created position of engineering manager at the U.S. Borax & Chemical Corp. mine and processing plants at Boron, Calif. He has been assistant mine superintendent.

Kendall

Bilharz

Oscar W. Bilharz has been appointed director of the Office of Minerals Mobilization. He has been acting director of the Department of Interior organization since the December retirement of **Spencer S. Shannon.**

Charles N. Gilmore has been appointed mine industrial engineer for Jones & Laughlin's New York Ore Div.

Ira E. McKeever has been appointed general manager of Texas Gulf Sulphur Co.'s sulphur operations. He has served as vice president of Texas Gulf's subsidiary, Texas Latin Exploration Co., and was assistant manager of mining exploration before his promotion.

Fritchoff Ring has retired as assistant chemist for Cleveland Cliffs Iron Co.'s Marquette range mines after 42 years of service with the company.

Jack L. Schumann has been elected president and a director of Buell Engineering Co. Inc. He succeeds **J. A. McBride,** who will continue as a board member and consultant.

Frederick W. Pfau has been appointed manager of the International Salt Co.'s Detroit rock salt mine to succeed **John L. Ryon Jr.** who has been named assistant director of production at the company's administrative headquarters.

Robert M. Reckeweg has been named president of Canadian Aero Service Ltd. The former executive vice president and general manager succeeds **Thomas M. O'Malley,** who now becomes chairman of the board of directors. **Grant Ray** was advanced to the post of secretary-treasurer.

Frank W. Wyatt has been named superintendent of the Globe Mining Co. uranium mill in the Gas Hills. He replaces **Kendrick W. Lentz,** who has moved to Grand Junction, Colo., for special assignments with the company.

ENGINEERS JOINT COUNCIL delegation to the USSR includes (seated, l-r) Lobo, Beatty; (standing) Dargusch, Hoeffding, Ingram and Mahoney.

EJC Sends Six to Study Soviet Engineers

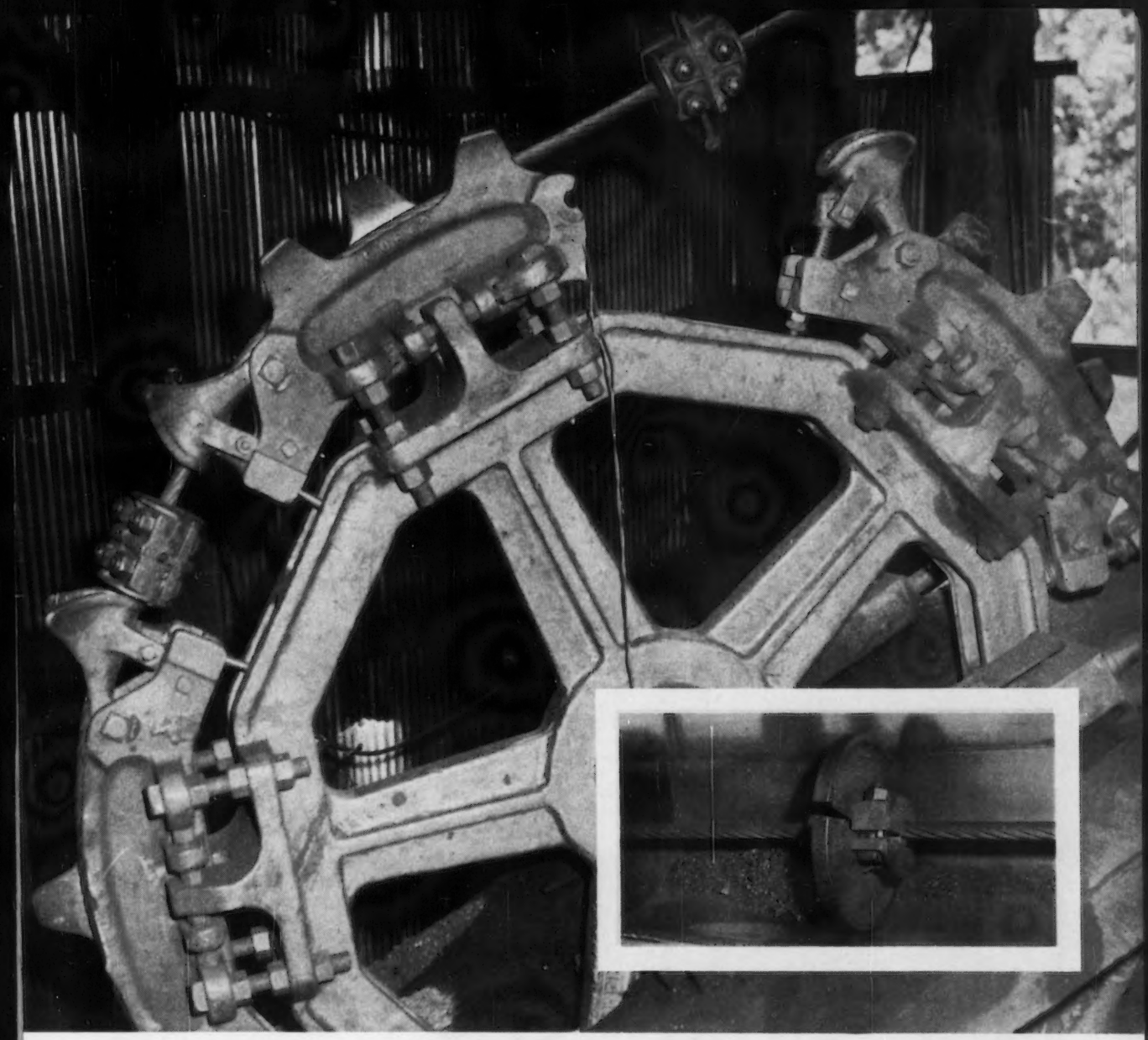
AN ENGINEERS JOINT COUNCIL delegation representing United States engineers spent last month in the USSR studying the utilization and allocation of Soviet engineers and technicians.

Delegates were chosen by Engineers Joint Council on the basis of professional training and experience and their knowledge of engineering manpower. The six represent a cross-section of engineering specialties, engineering education, and economics.

They are: **Walter E. Lobo,** delegation chairman, consulting chemical engineer; **H. Russell Beatty,** president, Wentworth Institute; **Carlton S. Dargusch,** advisor, Engineering Manpower Commission, Engineers Joint Council; **Oleg Hoeffding,** economist, Rand Corp.; **Sydney B. Ingram,** director of technical employment, Bell Telephone Laboratories Inc.; and **Robert M. Mahoney,** manager, industrial relations development, Union Carbide.

The six-man delegation left the United States June 22 and returned July 23. Under the auspices of the National Science Foundation and the U.S. State Department, the trip is a part of the Soviet-American program of scientific, technical and cultural exchange.

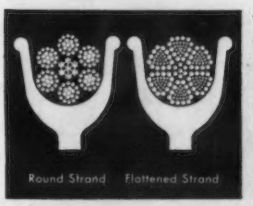
The Soviet Ministry of Higher Education extended the official invitation for the mission. A Soviet team will visit the United States at a later date.



40% longer life with Yellow Strand Flattened Strand at V & C Coal Company

After 7 years of abrasion, scuffing, shock loads, and moving 150 tons of coal per hour, Yellow Strand Flattened Strand Wire Rope has amply proved its extra value and long life to V & C Coal Company, Grays Knob, Kentucky. As the unretouched close-up photograph reveals, the rope is still sound, with no strand deformation and very little wear on the outside wires. Previous wire gave 5 years of service—Yellow Strand Flattened Strand is still going strong after 7 years. Button rotation is 46% less than previous ropes used, with very little button slippage.

For complete details on how well Yellow Strand Flattened Strand can serve you, contact your distributor or check with us. Broderick & Bascom Rope Co., 4203 Union Boulevard, St. Louis 15, Missouri.



These illustrations point up the reasons for Yellow Strand Flattened Strand's exceptional service: Each strand is laid up in a triangular pattern. Contact with the sheave groove is made by many wires instead of a few. Note the marked increase in compactness in Flattened Strand, with greater crush-resistance and 10% more metallic area.

Yellow Strand®
FLATTENED STRAND
WIRE ROPE

PERSONALS *(Continued)*

Wallace Macgregor has been appointed president of Climax Molybdenum Co. and elected vice president of American Metal Climax Inc., the parent company.

Macgregor

He succeeds **Frank Coolbaugh,** newly - elected president of American Metal Climax.

A former treasurer of Climax Molybdenum and controller of American Metal Climax, Mr. Macgregor has been a vice president of Homestake Mining Co.

Peter Darlington, New York City investment banker, and **John J. Leighton,** New York attorney, have been elected to the Board of Directors of Shattuck Denn Mining Corp.

William H. Love, general manager of the Hecla and Lucky Friday Silver-Lead Mining Companies, received an engineer of mines degree from the Montana School of Mines in June.

Earl S. Mollard, general manager of the Hanna Nickel Smelting Co. and the Hanna Mining Co. operation near Riddle, Ore., has been appointed to a four-year term on the governing board of the Oregon Department of Geology & Mineral Industries.

He succeeds **Lester R. Child,** whose term expired.

Robert L. Cranmer, Salt Lake attorney, has been named executive vice president and assistant general manager of New Park Mining Co.

He succeeds **Clark L. Wilson** who is now chairman of the Emergency Lead Zinc Committee.

Carl D. Harper, controller, was named secretary of New Park to succeed Cranmer.

Frank W. Chambers has been elected president of the Strategic Materials Corp. to succeed **John C. Udd,** who becomes chairman.

Chambers joined the company last fall as executive vice president after serving

Udd

Chambers

nine years as director of engineering for Kennecott Copper Corp.

Udd succeeds **Samuel D. Lunt,** who continues as a director and member of the executive committee.

Directors **Richard C. Ernst** and **Henry G. Schmidt** have been made members of the executive committee. **E. H. Damon,** controller, was elected treasurer.

MINING PRACTICES COMMITTEEMEN met June 2-3 at Kennecott's Nevada Mines Div., McGill, Nev., to review common problems and exchange ideas of mutual interest to the company's four Western producing properties. The mining practices committee is a companion group to the Smelting & Fire Refining Practices Committee (E&MJ, June 1960, p 96) and the Milling Practices Committee. Members of the group are (l-r) **L. A. Green,** Nevada Mines Div.; **H. A. Wilmeth,** Chino Mines Div.; **J. M. Haivala,** Chino; **R. Muse,** Nevada; **A. Soderberg,** chairman, Western Mining Div.'s Engineering Dept.; **V. S. Barlow,** Utah Copper Div.; **A. J. Thuli,** Utah; **J. C. Van De Water,** Ray Mines Div; and **H. W. Bishop,** Ray.

OBITUARIES

Ira L. Wright, 76, active for more than 40 years in the development and operation of mining properties in southwest New Mexico, died June 16.

Wright

A mining engineer and metallurgist, he had served as minerals advisor to the Federal Government and general manager and a director of Black Hawk Consolidated Mines Co.

Mr. Wright began his mining career with Chino Copper Co. (now Kennecott Copper Corp.) upon graduation from the Missouri School of Mines.

After several years with Chino he became a mine operator on his own at Pinos Altos, N.M., leasing a long dormant gold-silver producer and opened up a rich orebody.

He had been a director of AIME, member of the American Mining Congress and director of the New Mexico Mining Assn.

Albert L. Ferris, 71, mining engineer and geologist, died in April at his home in Tucson, Ariz.

Mr. Ferris began his mining career with Shannon Copper Co. in 1911. In the early 1920s he joined Phelps Dodge Corp. at Pilares de Nacozari, Sonora, Mexico, afterwhich he accepted the position of chief engineer for Cia Minera de Penoles.

In 1936 he went to Colombia, S.A., as mine superintendent of Timmins Ochali Mining Co. Ltd.'s Berlin Mine. He subsequently held the positions of examining engineer, Wellington Explorations Ltd., Medellin; manager, Tabano Mine, Tuquerres; and manager, Sonrisa Mining Co., Tuquerres.

John George Fletcher, 82, retired mining engineer, died June 25. He was educated at the Colorado School of Mines and worked in mines in Mexico, Alaska and along the east and west coasts before joining Standard Oil of California. He retired 15 years ago.

Horace Moses, 80, retired general manager of Kennecott's Chino Mines Div., died June 20.

Mr. Moses began his mining career in 1900 with Santa Rita Mining Co. where he served for three years as a miner and later foreman of a 100-ton concentrating mill located in the mining camp.

After six years working in a number of mining operations in Montana, Utah, Arizona and Mexico, Mr. Moses returned to Santa Rita to become mine superintendent of Chino Copper Co.

In 1917 he became general superintendent of Chino's subsidiary, Gallup American Coal Co., and later became general manager. He returned to Santa Rita in 1938 to become general manager of the Chino operations.

He retired in 1947.

Mr. Moses served as president of the New Mexico Mines & Prospectors Assn.

DENVER SRL PUMPS

Now available in TWO Models

GLAND TYPE
With Positive Water Seal

FOR AN EVEN WIDER RANGE OF PUMPING APPLICATIONS

GLANDLESS TYPE
No Gland—No Sealing Water

AVAILABLE IN THESE SIZES AND CAPACITIES

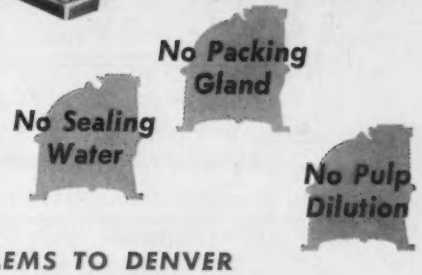
Specifications and Dimensions

Pump Size and Type	Capacity 60' Head RPM	HP	*Water GPM	Dimensions (In.) L	W	H	Approx. Ship. Wt. Lbs.
GLAND TYPE							
1½"x1¼"	2190	1.9	40	25	17½	26	525
2½"x2"	1500	4.9	160	25½	17½	26⅜	575
3" x3"	1400	6.8	260	31¼	19¾	31½	850
5" x5"	1060	17.4	800	37¾	26¼	36½	1550
6" x6"	1170	36.3	1600	45¼	28½	46½	2300
3" x3"—C	1450	8.2	260	37½	21½	33¾	1240
5" x4"—C	1035	12.6	700	40¼	27	37⅝	1600
8" x6"—C	920	39.8	1600	63	36½	49¼	4375
10" x8"—C	820	74.0	3300	68¾	43	57	5100
12" x10"—C	615	115.0	5000	69⅝	46½	63	5900
GLANDLESS TYPE							
3" x3"—C	1450	10.0	180	37½	21½	33¾	1240
5" x4"—C	1035	15.0	500	40¼	27	37⅝	1600
8" x6"—C	920	47.0	1200	63	36½	49¼	4375
10" x8"—C	820	87.0	2700	68¾	43	57	5100

*Based on water. Multiply horsepower by specific gravity of pulp to obtain actual brake horsepower.

DENVER "TRU-GLANDLESS" SRL PUMP... A MAJOR ADVANCE IN PUMP DESIGN

DENVER SRL Pumps with positive water seal already have a world-wide reputation for their high efficiency, low part cost, long life. If dilution of pulp or slurry is a problem, you now get the extra advantage of "TRU-GLANDLESS" construction. Requires no sealing water, no packing glands, eliminates pulp dilution.



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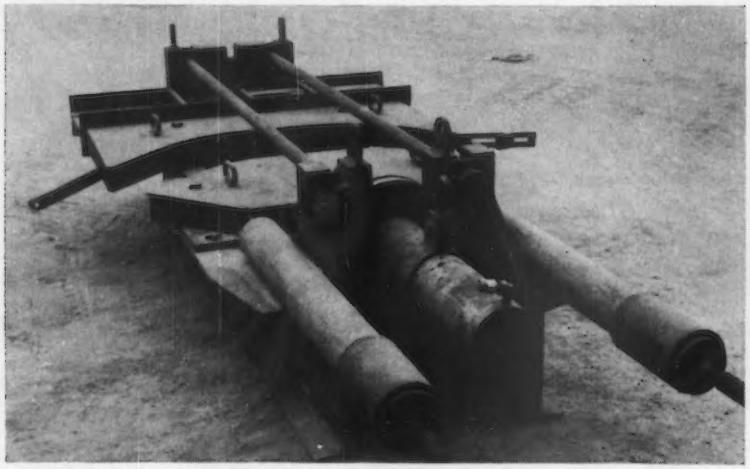
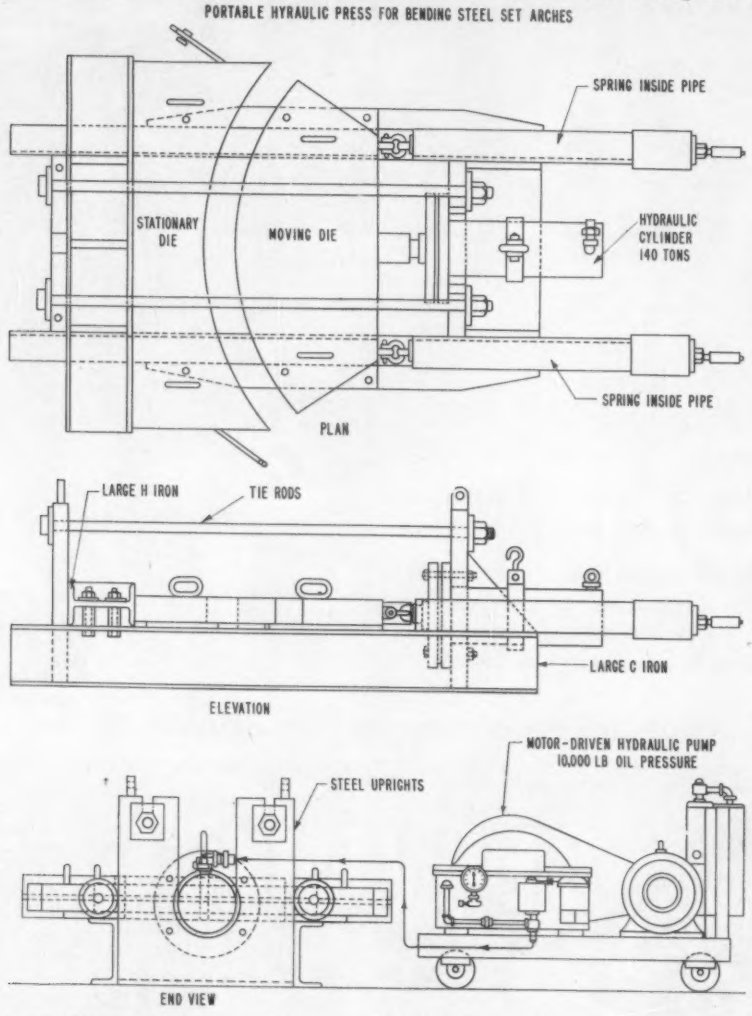
OPERATING IDEAS



HOME-MADE hydraulic press makes arch for steel rail sets used underground.



RAIL SECTIONS are inserted between stationary and moving die. Applied force is by hydraulic cylinder and counterforce to separate dies, by the steel springs.

Hydraulic Press Bends Arch of Drift Rail Sets

EARL SNODGRASS, master mechanic at the reduction works machine shops of San Manuel Copper Corp., San Manuel, Ariz., designed and built the portable hydraulic press shown for bending the arch portion of the steel rail sets used underground to reinforce weakened points in the concrete drift lining. These sets are made from two heavy rail sections, with each arch end connected by steel latches.

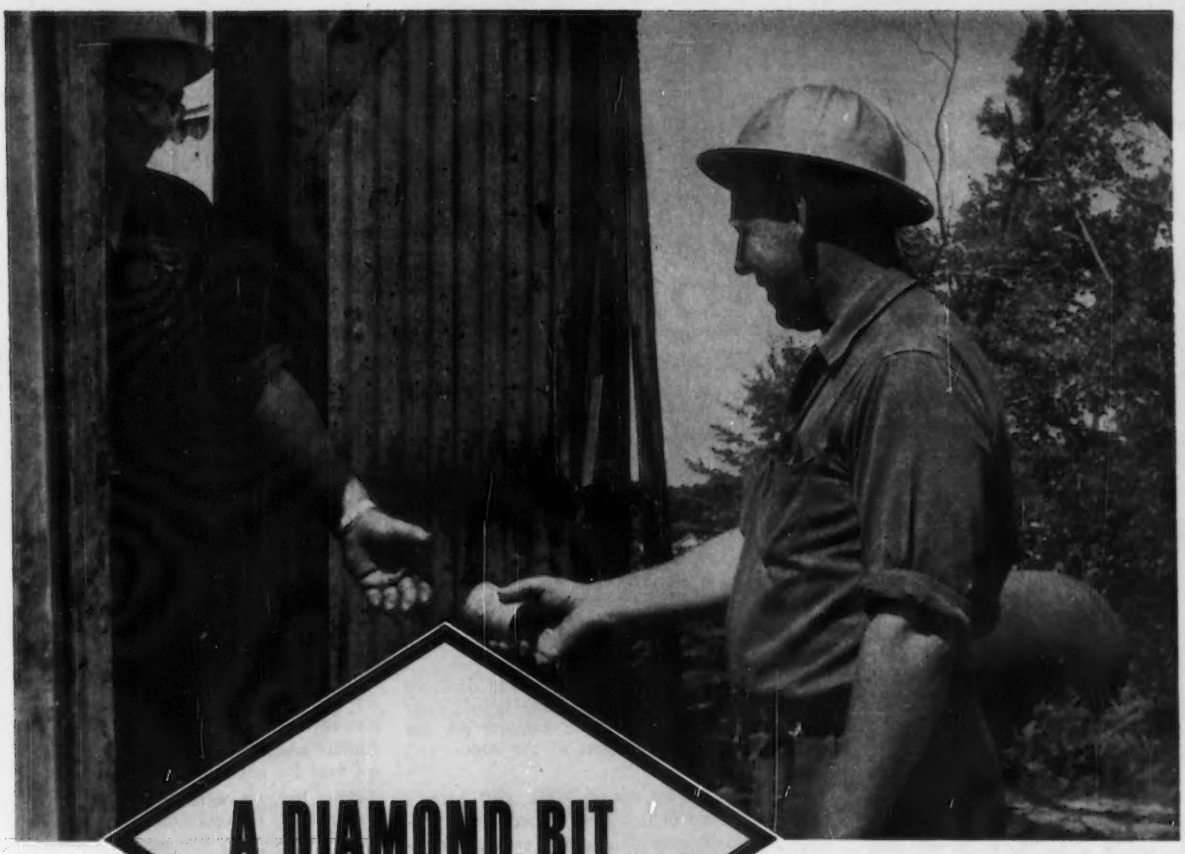
Prior to the use of the press, bending of the arch portion was done by hand—a time-consuming job. Also, extra fuel was required for reheating the rails during bending operations. The device consists essentially of a frame made from Channel and *H* irons and steel plate, a hydraulic cylinder capable of generating 140 tons pressure, two steel spring assemblies to retire the extended moving die, and stationary and moving dies for bending the arch on each rail section making up the set. A motor-driven hydraulic pump mounted on a four-wheel chassis provides the oil to the hydraulic cylinder of the press at any pressure desired. The portable feature of the press assembly makes it possible to use it in any convenient spot of the blacksmith shop and remove it when bending operations have been completed.

Note that the unit contains a series of cable hooks to facilitate assembling, moving and repairing the machine.

A Modified Internal Indicator for Iron

AN INTERNAL INDICATOR, consisting of a solution of 1% of diphenylamine sulphonic barium salt (Eastman Kodak) in sulphuric acid (1.84 sp gr), has brought excellent results in the determination of iron in ore at the Whyalla Works of the Broken Hill Co. Pty. Ltd, South Australia. Eight drops of the indicator are added to approximately 100 ml of 2N hydrochloric acid mixed with 10 ml of 50% phosphoric acid and the titration carried out in the cold. A background of diffused light from a fluorescent tube increases the sensitivity of the end point.

Further precautions are taken to reduce the iron with 10% stannous chloride at near boiling point with three drops excess. Stannous chloride has to be made up fresh daily. After adding 10 ml of saturated mercuric chloride to the cool reduced solution, it is stirred for one minute with a magnetic stirrer before commencing the titration.



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Whatever your drilling needs—underground or on the surface, exploration or blast holes, shallow or deep drilling with air, water or mud—you'll find that Christensen Diamond Bits are your assurance of drilling at "less cost per foot."

Christensen Diamond Bits cut straighter holes, last longer and cut even the hardest rock economically.

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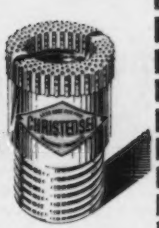


To obtain faster penetration, straighter holes, better diamond usage, unequalled service and experienced consultation, contact Christensen.

OPERATING IDEAS *(Continued)*

Extending the Usefulness of Mine Sheaves

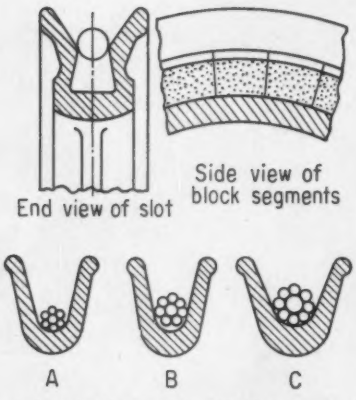
THE LIFE of the average malleable cast iron sheave can be extended over a long period of years by the use of oak shims keyed into the tapered groove cut with a conventional lathe according to Paul C. Ziemke, Clinton, Tenn.

Because the average sheave is much too large to swing in the lathe for the turning operation, the lathe is brought to the sheave. Then, the sheave is temporarily set on pillow blocks and swung on its axis. As the sheave is turned by auxiliary power transmitted through a bolted-on pulley on the sheave axis, the needed recess is cut.

The initial cut is taken with caution until the machinist gets the "feel" of the operation, and discovers the best angle of tool to use. He must also watch for blow-holes (gas pockets) in the structure of the iron.

The lagging of the old, deep groove is required since wire ropes will not support without injury the lateral crushing caused by the deep, narrow grooves. This V-shaped groove is particularly vicious on new ropes that have the proper, non-worn diameter originally designed for the hoist installation. The geometry and size of the wheel rim will determine the size of the taper cut needed or permitted for a given wheel. Too much thinning is warned against.

The oak or gutta-percha sectional members are locked in a correctly tapered groove. A section is measured on the wheel rim that is equal to the dimension of a single shim block. Next a perpendicular wall is hand cut and all the members inserted in the hole and driven around the circle. The final block is hand cut to a drive-fit dimension for the rectangular section and is locked in place on the rim by countersunk cap screws run into drilled and tapped holes previously provided in the special pockets base section.



OAK SHIMS can be keyed into a tapered groove on malleable cast iron sheaves. In A, the groove diameter is too large—the rope receives no support from the flanges and will cut into the bottom and be distorted. In B, the groove diameter is too small—the rope receives no bottom support. The rope is pinched and distorted by pressure from the flanges. In C, the groove is the correct diameter for the proper support of the rope.

The shimmed sheave will not wear as well as iron and much depends on the amount of grit in the atmosphere that clings to the rope dressing. The grit forms a mild type of grinding compound.

However, once the tapered groove has been established, it is not an expensive or tedious operation to slack off the hoist rope and drive out the worn blocks, replace them with new blocks, and restore the rope to action. While kiln dried oak is the choice of most operators, many choose the more expensive, but durable lignum-vitae.

Any shrinking or expanding of the wood can be eliminated by boiling the wood in paraffin until all bubbling ceases. At that point all moisture and air in the wood has been replaced by the paraffin.

Selecting Crusher House Chute Liners

CHILLED WHITE IRON (cast under different trade names and analysis) has provided the largest field for "engineered" savings on crusher house chutes, according to A. E. Alpine, general plant engineering division, Johns Manville Corp., Manville, N.J. By using the material in the correct location, exceptional life spans have been realized. However, care should be taken to design radius corners to uniform sections. With a little study, a chute liner may be designed so the area most susceptible to wear may be changed readily.

In a recent cost reduction meeting at the company, it was found that almost all of the original brake-formed plate type chutes have been replaced by the "crate construction" or "skeleton" chutes. The design calls for the use of angle iron corners with abrasive resistant (A.R.) plate liners making up the chute proper. Along with being practical, the weight and cost is reduced. Previously the liner wear could not be discerned readily—resulting in the outer chute plate wearing through. With "crate construction," this does not happen.

The Johns Manville meeting also produced comment on liner materials. Although each chute location requires individual attention to reduce maintenance, some of the following ideas (with local modifications) can result in improved maintenance and lower cost.

Manganese Steel Cast Liners are generally installed wherever enough impact is present to promote a surface-hardening effect.

Hi-carbon steel is acceptable in most cases but a cost comparison must be made.

Abrasive-resistant plate is readily cut and installed but is not recommended for severe abrasive conditions where high tonnages are handled continuously.

Chilled white iron has provided the largest field for engineered savings.

Rubber has, on occasion, brought excellent results. However, thought must be given to selecting the correct material. Rubber used as the wear medium in chutes is generally mounted over a plywood (any wood acceptable) base if any impact is likely to be encountered.

Pocket chutes are becoming more popular and are used whenever a turn or drop is encountered in the system. By checking the existing design, a chute or turn section may be eliminated and replaced by a pocket. The pocket stores material and after the angle of repose has been established, the only wearing surface is the leading edge. The wearing bar may be made easily reversible or replaceable and is considerably cheaper than replacing liners.

Unique Materials

Some unique installations have been devised during war years and in isolated operations. Some ideas experimented with are included below.

Glass liners, one-in. thick, have been used. The glass was held in place by spring-loaded bolts mounted over used conveyor belt.

Basalt is an excellent material but is more commonly used on large ore pockets and similar installations. It does not lend itself to small chutes.

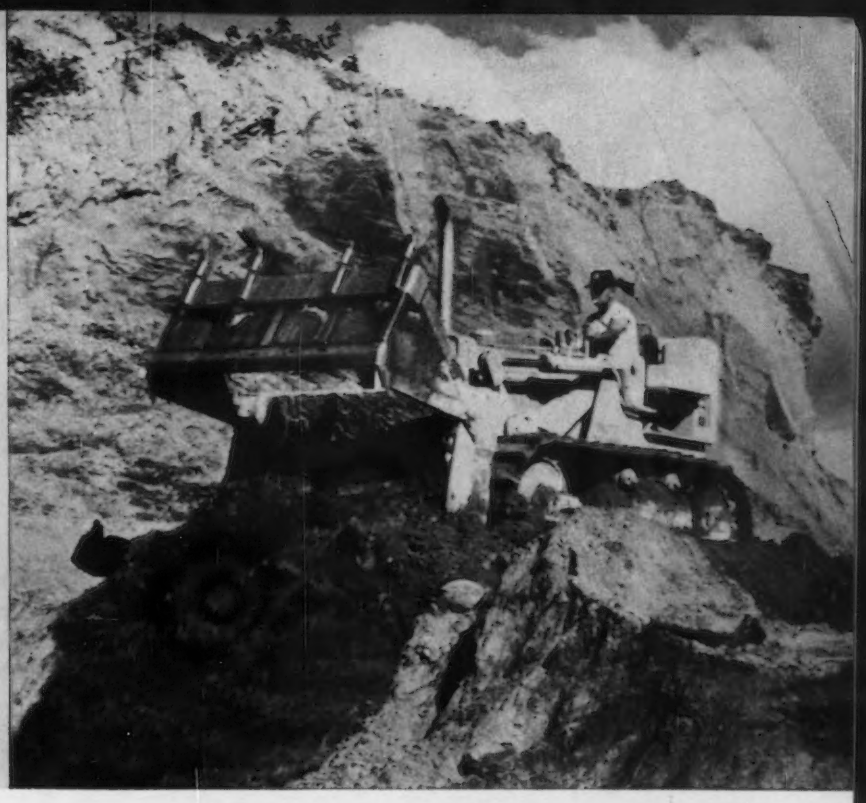
Used jaw crusher plates may be cut and fit similar to any liner plate.

Wood is objectional to many products (definitely asbestos). Elm plank wears well, especially if moisture is present.

Concrete reinforced with used cables, used mine rails, etc., as well as concrete to which a surface hardener has been added are acceptable in some cases.

Raise the clam and you have a full-size, full-capacity dozer for stripping overburden or pushing gravel down the bank, tons at a time. 'Dozer rides on exclusive "skid shoes," to keep cut accurate, and prevent uneven blading.

Doubles for DOZER, SHOVEL, SCRAPER, CLAMSHELL... *even dynamite!*



Clam-action 4-in-1 offers you money-making possibilities, unlimited

Open the clam of an International Drott 4-in-1 and a whole new range of equipment versatility opens for you. Each big-capacity 4-in-1 action "doubles" for one or more specialized earthmovers!

Skid-Shovel action takes over for the power shovel —and with tremendous triple-power, pry-over-shoe break-out action often doubles for dynamite in grubbing stubborn stumps, buried boulders, or hard clay, gumbo, and rock. *"Carry-type scraper"* action works like a scraper or dragline on jobs like stripping overburden...also gives you grader-like precision on haul road maintenance. *Clamshell action* lets you "back-drag"; grab and load solid objects like stumps; "surround" loose materials without chasing them! *Bulldozer action* gives you versatile blading, depth-regulated by radius control!

You adjust and control each 4-in-1 action, seconds-fast, hydraulically from the tractor seat. Each action gives you a wide range of job-handling working positions. And only the 4-in-1 has the positive performance protection of shock-swallowing Hydro-Spring!

Just move the machine selector lever to put a whole spread of equipment actions at your fingertips!

Prove first hand that a versatile 4-in-1 can give you money-making ability, unlimited! Let your International Drott distributor demonstrate!

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Instead of burrowing into the bank and risking slide dangers, use clam to back-drag loose material within safe reach. Then load either with clamshell or regular 4-in-1 bucket action.

Get higher reach than roll-forward type buckets by bottom-dumping! Opening the clam pulls sticky material from bucket surfaces—gravity pull does the rest!

Even moving a blade-full of shot-rock around the curve, there's no hesitation, no sluing to spill the load. The TD-25's operator has separate speed control of each track to get full-capacity performance, full time. And only the new TD-25 has the power plus of the direct-start, turbocharged DT-817 International engine—that delivers 230 high-torque hp!

HOW POWER-STEERED, POWER-SHIFTED . . . TD-25 takes

—on California mining operation

Even before all the blast dust has settled, this International TD-25 is slamming tons of shot-rock from the benches, so trucks can resume hauling to the processing plant. Then, at this gypsum mine in California, the "25" takes over the "shovel-feeding" chore—dozing full blades of rock upgrade, downgrade, and 'round the curves, to help keep the big dippers swinging full. And in between times, the "25" takes over its third tough project: benching new haul road around mountain slopes!

Three slam-bang rock operations to handle—it's a made-to-order situation for the Planet Power-steered TD-25!

"Dead-track drag" eliminated! You don't brake a track and "half-kill" your pull-power to turn, as you do with king-sized clutch-steered crawlers. With Planet Power-steering you simply change the speed of one TD-25 track—on-the-go, and with 2-finger ease! Around comes the fully-loaded TD-25—with "live" power on both tracks and both tracks pulling. Load-limiting "dead-track drag" is eliminated!

And combined, on-the-go Hi-Lo power-shifting lets you match power to load, instantly—forward or reverse. Just shift one track to high range—the other to low—to do slope-hugging, full-bite benching, or to operate straight ahead with off-center loads!

The "25" is platformed on new 7-roller tracks with double-box-beam frames. The design provides super undercarriage strength for slam-bang conditions—strength to match the full effort of the direct-start, high-torque DT-817 International Diesel engine.

Power-steer and power-shift the TD-25 with king-sized loads. Measure the bonus capacity you get with exclusive Planet Power-steering and Hi-Lo power-shifting. See how this control combination enables you to outearn other big rigs up to 50%. Then measure what it means to get this double-barreled advantage *only* in the TD-25—and as standard equipment *to boot!* Let your International Construction Equipment Distributor demonstrate.

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"Boulder-dozing" after blasting— The TD-25 does some "blasting" itself to move "big-as-a-house" hunks of rock aside. Heavy-duty TD-25 Dura-Rollers defy the rock-dozing "grind"—with the industry's thickest shells to prevent flexing—positive grit exclusion—and 1,000-hr.-interval lube capacity!

Here's your 76-page cost and production estimating book—newest, most authentic and complete guide for estimating material-moving costs—and for selecting equipment combinations for top profits, *anywhere!* See your International Construction Equipment Distributor!

over three slam-bang rock jobs

WHAT'S NEW IN PATENTS

OLIVER S. NORTH

U.S. PATENTS

Metal and Mineral Processing

In drying wet iron-oxide ores, a sinter bed, consisting of a layer of recycled dry ore overlaying a thicker layer of fresh wet lump ore, is sintered to produce a screenable mixture of dried particles and heat-hardened particles. Coal may be added to the recycled ore. H. Rausch, K. Meyer and K. H. Lintermanns, assigned to Metallgesellschaft A.G. No. 2,941,881.

In an improved furnace for smelting iron-ore concentrate briquettes, two melting chambers are arranged end-to-end, with burners at the outer end of each. Hot gases from the melting chamber are split into two fractions, one portion being returned to the outer end of the melting chamber and the other sent into the preheating chamber. Heat is used to greatest advantage. O. F. Swenson. No. 2,940,744.

Design for a magnetic ore separator of the wet type, low-cost and high-capacity, particularly useful in scalping magnetite and other ferric materials from ores of tin, tungsten, titanium, columbium, zirconium, rare earths, and the like. J. H. Carpenter. No. 2,939,580.

COPIES OF U.S. patents can be purchased at 25c each from the Commissioner of Patents, Washington 25, D.C.

Method of producing zirconium tetrachloride by chlorination of ground zircon, baddeleyite, or similar oxidic zirconium source material. The ore is mixed with pulverized petroleum coke and sodium silicate. The mixture is granulated to a mesh size of 16-140, and the granules are chlorinated in a fluidized-bed reactor. J. W. Andersen, assigned to Monsanto Chemical Co. No. 2,940,826.

In a method for removing hafnium impurities from zirconium, an aqueous acidic solution containing zirconium, hafnium and chloride ions is treated with a water-immiscible ketone solvent phase containing thiocyanic acid, the hafnium-containing organic phase is separated, and the zirconium-enriched aqueous phase is treated with additional quantities of the ketone solvent. L. G. Overholser, C. J. Barton Sr. and J. W. Ramsey, assigned to U.S. Atomic Energy Commission. No. 2,938,769.

Mr. North is patent consultant, Washington, D.C.

Design for a gravity-type ore separator for use in concentrating the various values found in black sands or beach sands. Uniformity of sand flow is maintained in all splitter channels, and high throughput is attained. E. A. Hobart, assigned to Hobart Brothers Co. No. 2,938,627.

CANADIAN PATENTS

Metal and Mineral Processing

In concentrating thorium silicate minerals from ferruginous thorite ores, such as those found in the Wet Mountain section of Colorado and the Lemhi Pass section of Montana, a mixture of ore, soda ash, lime, borax and wood charcoal is melted in a muffle furnace. A thorium-containing slag is separated from an underlayer of molten pig iron. D. H. Fenske and R. T. Sorensen, assigned to International Minerals & Chemical Corp., April 26, 1960. Canadian 597,012.

In a fractional precipitation method for separating lanthanum from all other rare earths, monazite ore is dissolved in hydrochloric acid, and then treated in stepwise manner with an alkali or ammonium hydroxide in the presence of formic acid, acetic acid, or a like carboxylic acid. Rare earths other than lanthanum are precipitated. The residual solution is then treated with ammonium carbonate to precipitate lanthanum carbonate. P. Krumholz. May 3, 1960. Canadian 597,180.

In an ion-exchange method for separating rare earths, particularly yttrium, the ion-saturated resin bed is eluted with a solution of ethylene-diamine tetra-acetic acid, and successive portions of the eluate are collected. These fractions are enriched in different ions according to the relative stabilities of their complexes. P. Krumholz. May 3, 1960. Canadian 597,181.

In a fluidized-bed method for reducing ferric iron-oxide ores to magnetite, at least three separate beds are maintained in the reactor: preheating, heating and final treatment. Excess heat is used in the heating zone, and in the final treatment zone highly-heated solids from the middle section are mixed with ore solids coming directly from the preheating zone. Heat transfer occurs instantaneously, and maximum fuel economy is realized. T. D. Heath, assigned to Dorr-Oliver Inc. May 3, 1960. Canadian 597,286.

To make crude kaolin less viscous and thus better for coating paper, it is mixed with water, purified, bleached, flocculated, filtered and dried. The dried material is suspended in water and again flocculated, filtered and dried. The operation is repeated until the desired viscosity is obtained. B. W. Rowland, assigned to Georgia Kaolin Co. May 3, 1960. Canadian 597,486.

Nitric acid leaching process for recovering from laterite, garnierite, ilmenite, taconite or the like, a high-grade ferric oxide product, and also other metal values dissolved during leaching. Ore is dissolved in an excess of nitric acid leach solution at a temperature below 250° C. The leach solution is separated from insolubles and heated to 50-250° C, under pressure, to an optimum mol ratio of iron to other metal ions present, so that a controlled quantity of high-purity ferric oxide is precipitated. The remaining solution is recycled. At intervals, portions of this solution are withdrawn and processed to recover other metal values, e.g. nickel and cobalt, and nitric acid. F. A. Schaufelberger, assigned to Sherritt Gordon Mines Ltd. May 3, 1960. Canadian 597,512.

In the direct reduction of iron-oxide ores to form sponge iron, pulverized ore is pelletized; the pellets are mixed with a flux, sodium carbonate, and an excess of finely divided carbon, e.g. anthracite coal fines. The mixture is fired to 1900-2100° F in a rotating furnace. A supply of air is introduced into the kiln. The excess carbon and resulting ash residue prevents the pellets from sticking together. The solids leaving the kiln are cooled in a non-oxidizing atmosphere. H. Freeman, assigned to Freeman Corp. May 10, 1960. Canadian 597,656.

Design for an ore-sintering-machine pallet having a grate-bar carrying frame which may be readily inverted and fixed in inverted position, so that after the frame has begun to sag, it can be inverted so as to have a slight arch, whereby the life of the pallet is increased. The grate bars are simple rods that can be produced in a rolling mill more cheaply than the usual forged or cast bars. E. B. Hudson, assigned to Armco Steel Corp. May 10, 1960. Canadian 597,891.

Copies of Canadian patents can be obtained by writing to the Patent Office, Ottawa, Canada.

Design for a sintering-machine pallet return mechanism. The pallets move slowly during the sintering operation and while passing over the tail sprocket, are then engaged by an endless conveyor and rapidly returned to the head sprocket for re-use. Fewer pallets are required than when pallets abutt one another all the way around the sintering and return path. Another advantage is re-use of the emptied pallet before it has had time to cool off appreciably. E. B. Hudson, assigned to Armco Steel Corp. May 10, 1960. Canadian 597,918.

HALLIBURTON

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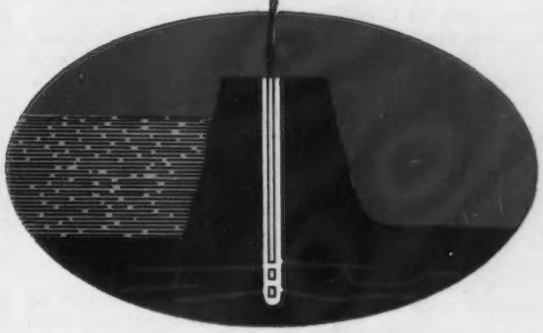

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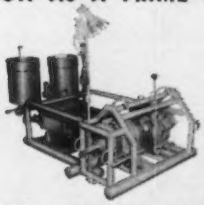

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New Books

Statistical Handbook of Science Education. Major parts of the publication include human resource data, population, educational levels of population, college degrees awarded, qualifications of teachers, institutional financial data, numbers and types of schools, expenditures, tuition costs, financial aid, and numerous statistical tables. Published by the National Science Foundation. Copies may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Pp 94. Price 55c.

Electronic Instruments for Detecting and Assaying Beryllium Ores, by S. H. U. Bowie, H. Bisby, K. C. Burke and F. H. Hale. Extract from Transactions of the Institution of Mining & Metallurgy, Vol. 69, Part 7, 1959-60. The detection of beryllium-bearing minerals is facilitated with a portable electronic instrument employing boron trifluoride counters to measure neutrons emitted when beryllium is bombarded by gamma radiation of suitable energy. Similar equipment for laboratory use enables accurate analyses of beryllium ores to be made without the need of costly and time-consuming chemical analyses. Reprinted pamphlet received from the Geological Survey of Great Britain, Atomic Energy Div., Young Street Office, London, W. 8. Pp 18.

Index to Geophysical Abstracts 176-179, 1959. Published by the U.S. Geological Survey as Bulletin 1106-E. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Pp 90. Price 35¢.

The following reprints of the joint meeting of East-Central, West Central and Southern Regional Committees on Geology at Leopoldville, 1958, were transmitted by the Department of Geological Survey, Dodoma, Tanganyika, East Africa:

A Preliminary Note on the Quaternary Geology of Tanganyika, by R. Pickering. Pp 14.

East-Central Regional Committee for Geology, Sub-Committee on Stratigraphical Nomenclature, by A. M. Quennell. Pp 26.

The Environment of Some Copper Deposits near Mpanda, Tanganyika, by A. P. Fawley. Pp 3.

Charnockites in Tanganyika and Their Associated Rocks, by A. E. Wright and T. C. James. Pp 2.

Structural Mechanics, by Samuel T. Carpenter, professor of civil engineering and chairman of that department at Swarthmore College. Major chapters include the deflection theory, basic principles of indeterminate structures, moment distribution, elastic center and column analogy methods, work and energy methods, variable moment of inertia, arch theory, the cable, structural dynamics and axially loaded members and beam columns. The relationship between structural theory and engineering mechanics is stressed in this book. Published by John Wiley & Sons Inc., 440 Fourth Ave., New York 16, N. Y. Pp 538. Price $9.50.

Concept of Thermodynamics, by Edward F. Obert, professor of mechanical engineering, University of Wisconsin. This modern approach to engineering thermodynamics emphasizes the fundamentals of the calculus and gives a physical significance to each function that underlies the symbol of a concept. A rather complete section on the calculus has been included in the appendix and a survey of methods for solving the equations of thermodynamics is included in one of the chapters. Terminology is defined in a table at the beginning of the book which lists terms used in the book, symbols used for these terms in mathematical equations, dimensions of various constants and variables, and the page numbers of sections discussing the terms. Published by McGraw-Hill Book Co. Inc., 330 W. 42 St., New York 36, N. Y. Pp 528 plus 6 charts. Price $11.

BOOKS presented on this page may be obtained directly from the publisher mentioned in each case. E&MJ does not sell books.

The Engineering Index—1959. One of the most complete abstracting services covering world-wide technology. The 1959 index contains more than 39,100 annotations of articles reviewed in some 1,700 publications of engineering, scientific and technical societies, engineering and industrial publications, publications of government bureaus, engineering experiment stations, universities, and other research organizations. Published by Engineering Index Pp 1,532. Price $70 postpaid.

State Reports

State of South Dakota, 56th Annual Report for Fiscal 1958, by William F. Ellery, Inspector of Mines, Lead, S. D. Pp 22.

State of Missouri, 72nd Annual Report, Division of Mine Inspection, Department of Labor & Industrial Relations, 1959, by Floyd E. Henson, director. State Capitol Bldg., Jefferson City, Mo. Pp 70.

Georgia, Department of Mines, Mining and Geology, by Garland Peyton, Director State Division of Conservation. Includes list of publications on the geology and mineral resources of Georgia and an index to maps of Georgia. Available from the Geological Survey, 19 Hunter St., S. W., Agricultural Bldg., Atlanta 3, Georgia. Pp 9 plus map.

Directory of Known Mining Enterprises, by Frank Crowley, Montana Bureau of Mines & Geology, Room 203 Main Hall, Montana School of Mines, Butte, Mont. Pp 64 plus map locating 200 mining districts.

Geologic and Aeromagnetic Compilation Map of Northern Maine, prepared by U. S. Geological Survey Staff Personnel. in cooperation with the Maine Geological Survey. Regional geologic and magnetic maps covering 12,000 sq miles of parts of Franklin, Somerset, Piscataquis and Aroostook counties in northern Maine have been released on open file by the U. S. G. S., Washington, D. C. Sets of black and white prints are available from Robert G. Doyle, state geologist, Department of Economic Development, State Office Bldg., Room 211, Augusta, Maine. Price per set of maps for reproduction and mailing, $2.45.

USBM Publications

The following publications may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., for the prices stipulated for each publication:

Tungsten Mining and Milling in Boulder County, Colo. Information Circular 7936, by Carl Belser. Includes production of the area, mining methods, and 13 flowsheets of concentrators. Pp 54. Price 40¢.

Tungsten Resources of Montana Deposits of the Mount Torrey Batholith, Beaverhead County. Report of Investigations 5552, by Eldon C. Pattee, Pp 40 including 36 maps and illustrations and 3 tables. Price $1.25.

Manganese Deposits of the Olympic Peninsula, Wash. Report of Investigations 5530, by E. A. Magill. Pp 82, including 54 maps and illustrations. Price 50¢.

Phosphate Rock, Part II, Processing and Utilization. Information Circular 7951, by William Waggaman and E. R. Ruhlman. Pp 36. Price 30¢.

Mining Methods and Costs at the Piokee Mining Unit and Piokee Experimental Mining Project, The Eagle-Picher Co. (Tri-State Mines), Ottawa County, Okla. Information Circular 7930, by J. B. Elizondo. Pp 26. Price 25¢.

Mining Methods and Costs, Black Rock Tungsten Mine, Wah Chang Mining Corp., Mono Corp., Mono County, Calif. Information Circular 7945, by A. C. Johnson and N. M. Fillip. Pp 19. Price 45¢.

Reconnaissance of California Manganese Deposits, Report of Investigations 5579, by Russell Trengrove. Pp 46. Price 35¢.

Sources of Refractory Raw Materials and Refractories Markets in South Central United States. Information Circular 7950, by Howard Rollman and Harvard Eng. Pp 54. Price 40¢.

Uranium Mining Practices and Costs at Ten Salt Wash Lease Operations of Union Carbide Nuclear Co. Information Circular 7922, by W. L. Dare. An excellent analysis of mining costs per ton in terms of labor, supervision, explosives, drill steel and bits, fuel oil, gas and electricity, repairs and maintenance, equipment rental and other supplies. Pp 71. Price 60¢.

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Flintkote Acquires Newfoundland Gypsum Rights

THE FLINTKOTE CO. has reached "a basis of understanding" with the Province of Newfoundland which will give the company immediate access to some 40 sq mi of gypsum-bearing properties at Flat Bay. Subsequently Flintkote will have mining rights to additional deposits in a 3,000-sq-mi area. Core drilling has indicated gypsum reserves of "at least 200-million tons" of high-purity gypsum, according to a company spokesman.

Acquisition of the property will be covered by a 99-yr lease, renewable for another 99 yr. As part of the agreement, Flintkote will acquire certain assets of Atlantic Gypsum Co. Ltd. at Corner Brook, Nfld., for $1-million cash. Assets include material and equipment to build a 6-mile aerial tramway from existing deposits at Flat Bay to a deep-water shipping point near St. Georges, together with a pier and shipping facilities.

Access to the huge gypsum reserves in Newfoundland will enable Flintkote to rank among the top four domestic producers of gypsum and gypsum products in the near future, the company believes. In addition to developing the mine and transportation facilities at Newfoundland, Flintkote will build three new domestic gypsum plants on the Atlantic seaboard and the St. Lawrence seaway requiring an investment of approximately $20-million during the next five years, company officials said.

The company now operates a mine and plant at Las Vegas, Nev., and at Sweetwater, Texas. Flintkote has also optioned gypsum properties near Fort Dodge, Iowa, which may support another plant in that area.

Mining and shipping from the Flat Bay area will start in the spring of 1961 after completion of the tramway and port facilities. Production rate will be about 500,000 tpy of rock, with provisions to double that output if necessary. Flintkote will pay the Government of Newfoundland a royalty of 5¢ per ton. Weather conditions will permit shipping about 10 months each year. Stockpiles of about 100,000 tons at gypsum plants will permit year-round operations.

Acquisition of the Newfoundland mining lease is the culmination of an intensified search for gypsum reserves by Flintkote in 13 states of the U.S., four provinces in Canada, five Latin American countries and two Caribbean islands.

Flintkote's interest in producing gypsum dates back to the successful trial operation of a mine and plant at Sweetwater in 1956. Later it acquired the Blue Diamond operations in Nevada. Currently gypsum sales account for about 10% of Flintkote's gross. Within five years the company expects to build up sales volume of gypsum and gypsum products to $75- to $100-million per year.

THE WASH PLANT will handle ore from the two connected pits at about 500 tph capacity. The mine is at the extreme west end of the Mesabi.

J&L's Lind-Greenway Starts Shipping

ANNUAL PRODUCTION of about 700,000 gross tons of "high-quality beneficiated ore" is expected from the new Jones & Laughlin mine near Grand Rapids, according to C. C. Henning, J&L's general manager of mines and quarries. The mine is being operated under the firm's Minnesota Ore Div. and is called the Lind-Greenway, named for the two pits from which ore is hauled.

The pits are connected across Minnesota's Prairie River by a truck bridge.

Ore is loaded into 40-ton trucks by 6-cu-yd shovels in the pit and hauled to 100 tph capacity cone crushers, where it is taken down to 1¼-in. Conveyors move it to the 500-tph washing plant and then it is loaded onto railroad cars for the trip to J&L's plants at Pittsburgh, Aliquippa and Cleveland.

$2,000 Geology Fellowship Is Available

THE S. F. EMMONS Memorial Fellowship in economic geology will be available for the academic year 1961-62, the fellowship committee has announced.

Applicants may obtain forms from any member of the committee: Prof. Alan M. Bateman, Yale; Prof. Chas. H. Behre, Columbia; and Prof. H. E. McKinstry, Harvard. Applications and supporting letters, which should include a detailed statement of the problem to be investigated, should be submitted not later than Feb. 15, 1961.

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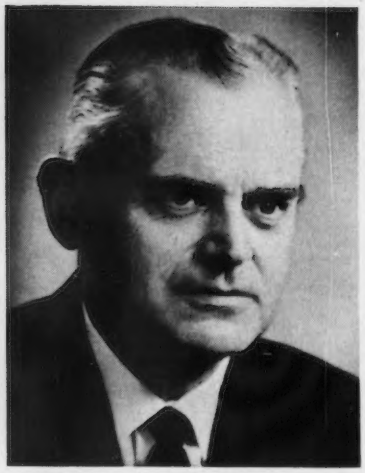
J. M. EHRHORN, director of industrial development and exploration for USSR-&M is conference chairman.

MRS. A. J. THULI will serve as ladies events chairman at the sixth annual Rocky Mountain Minerals Conference.



ADOLPH SODERBERG, consulting engineer of Kennecott Copper Corp.'s Western Div. is program chairman.

Exploration Panel Planned at Rocky Mt. Meeting

THE THREE-DAY Rocky Mountain Minerals Conference, to be held in Salt Lake City Oct. 5-7, is anticipating a registration of more than 500 mining industry representatives, according to J. M. Ehrhorn, chairman of the conference committee.

The meeting, to take place the week before American Mining Congress' annual mining show at Las Vegas, Nev., will feature discussion of natural gas in Utah, the "sonic-resistivity method of log interpretation," geomechanics, salt production, and the new electric wheel truck at Anaconda's Berkeley Pit.

Other highlights include discussion of the "Role of Microorganisms in Leaching Process," part of Kennecott's famed bacteria leaching study; Standard Metals Corp.'s Silverton project; undersea mining; and the Vernal Phosphate Project of San Francisco Chemical Co., reagent systems design and fused electrolysis.

Francis Cameron of St. Joseph Lead, C. P. Pollock of Asarco and C. C. Huston of Toronto will discuss ore search costs and objectives at an exploration symposium, to be held in the morning of the final day.

Luncheon speakers include Joseph L. Gillson, AIME president, and Gen. Maxwell E. Rich, adjutant general, Utah National Guard.

Serving on the committee with Ehrhorn, director of industrial development and exploration, United States Smelting Refining & Mining Co., are the following:

H. E. Wright, assistant general chairman, executive vice-president, Galigher Co.; Adolph Soderberg, program chairman, consulting engineer, Western Div., Kennecott Copper Corp.; J. E. Van Stone, entertainment chairman, district manager, Hewitt-Robbins Inc.; J. LeRoy Peterson, arrangements chairman, engineer, W. S. Tyler Co.; and Mrs. A. J. Thuli, ladies events chairman.

The first afternoon will be devoted to a field trip to the Bacchus Plant of Hercules Powder Co. At this plant, located about 20 miles west of Salt Lake City, visitors will see operations which encompass the making and testing of rocket motors and propellent fuels, production of nitroglycerin, and regular mine explosives.

New Mill for Shirley Basin Is Considered

A SPOKESMAN for the Grand Junction Operations Office of Atomic Energy Commission says there's no bar to construction of new uranium mills in the 1962-66 period.

Allan E. Jones, general manager of the Grand Junction Operations Office, said that owners would receive no special amortization allowance. There would, of course, be no haulage allowances for miners, and the agency will not buy more than 500 tons of U_3O_8 of appropriate quality from any one mine unit. The price, of course, would be a flat $8 a lb.

He also disclosed that some progress had been made in defining what a "mine" was in terms of that 500 tons of U_3O_8.

Jones made the remarks in the course of discussion of milling facilities for millions of tons of uranium ore in Wyoming's Shirley Basin, 60 mi west of Casper. Much of the ore has not yet been allocated to mill.

Both Tidewater Oil & Co. and Kerr McGee Oil Industries Inc. have proposed construction of a mill to AEC. In recent days, Hidden Splendor Mining Co. and Federal Resources Co., both of Salt Lake City, joined with Gas Hills Uranium Co., in proposing construction of a 1,000 tpd mill and sale of 1-million lb of U_3O_8 concentrates (500 tons) annually to AEC from Shirley Basin properties owned by Gas Hills.

Utah Construction & Mining Co., another major reserve holder in Shirley Basin, currently is shipping ore to its Lucky Mc mill from the basin. The Lucky Mc mill is at Riverton, Wyo.

Jones said that it would be up to the Shirley Basin operators to decide whether they could make any profits by building a mill under conditions inherent in the 1962-66 concentrates purchase program.

He said AEC had not released total reserves on a district basis—only on a state basis.

But it is apparent there are sufficient reserves qualifying for mining within the terms of the 1962-66 program to accommodate a mill up to 1,000 tpd in size.

Jones said that some operators in the district believed that they could build a mill for what it would otherwise cost them to haul ore to any existing facilities—either at Gas Hills area or Salt Lake City.

Further, AEC has completed ore allocations in the Gas Hills area. Jones stressed that no purchases of uranium oxide from any future Shirley Basin mill would be made prior to March 31, 1962.

But factors militating toward construction of a mill in the big basin uranium field include desire of operators to maintain operations in the district after end of the 1962-66 program. More than half of the reserves discovered to date in the

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Expensive, time-consuming blasting of overburden is a thing of the past at the Harrisonville, Ohio, strip mine of the Swisher Coal Company. Caterpillar D9 Tractors with No. 9 Rippers loosen the sandstone overburden, which is then removed by a fleet of Cat DW21 Tractors, pushloaded by D9s.

In addition to saving the cost of shooting, the Pomeroy, Ohio, company saves the cost of reclamation. DW21s spread the excavated overburden over a large area, eliminate spoil banks entirely. The overburden averages 50 feet, covers a 2-foot coal seam. Production at the mine averages from 1000 to 1200 tons daily.

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NEW D9E—
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Uranium Mills *(Continued)*

district do not qualify under the Nov. 24, 1958, cut-off date announced by AEC. The commission, in modification of its promise to buy 500 tons of U_3O_8 from any one mine in any one year to Dec. 31, 1966, said it would not purchase such concentrates from ores discovered after Nov. 24, 1958.

"We still maintain the 500 ton figure as a limitation, or maximum amount of concentrates we will purchase," Jones said.

Shirley Basin operators figure that after 1966, if they had no mill, they would be placed at an economic disadvantage with other districts with reserves and fully amortized and paid for concentrators.

Conversely, if they did have a mill, they would be in a superior position over districts with mills and no reserves. Much of the reserve of uranium ore which is not available for production in 1962-66 program is in relatively shallow deposits, amenable to low cost open cut production. This mining cost factor may be compared with other districts which will have reserves after 1966—but which will also have much higher mining costs from underground operations.

On plus side, the Shirley Basin operators also can gamble that there will be some sort of limited purchasing by AEC after 1966.

This purchasing might be well under the $8 a lb price.

If so, their favorable economic position in regard to mining cost and a mill paid for from operations in the 1962-66 period would weigh to their advantage.

It is very probable these considerations have induced many of the operators—most of them major firms—to continue drilling up reserves at Shirley Basin.

Jones says that despite the fact that Shirley Basin operators and reserve owners would be "free" to build a mill and make the gamble on the economics of operation in the 1962-66 program with benefit of special encouragement of the government, they still would have to go through the formality of signing contracts with the agency.

Nonetheless, the construction of a new mill or mills in Shirley Basin would not be without impingement on the domestic program.

First, there are some mills still seeking ore allocation and a 1962-66 contract. The Salt Lake mill of Vitro Chemical Co. is an example. Vitro has looked toward Shirley Basin as a possible ore supply.

Second, if Shirley Basin operators lead off confidently and in some expectation of a uranium purchase program after 1966, other operators in other districts may be encouraged to resume drilling for uranium. This could result in a mild upswing in prospecting for uranium in the U.S.—particularly in the area of existing mills.

Jones says that because of the Nov. 24, 1958, cut off date, he doesn't feel any decision of the AEC to let operators build a new mill capacity would have any practical effect in the business—except in Shirley Basin.

He did confirm that in connection

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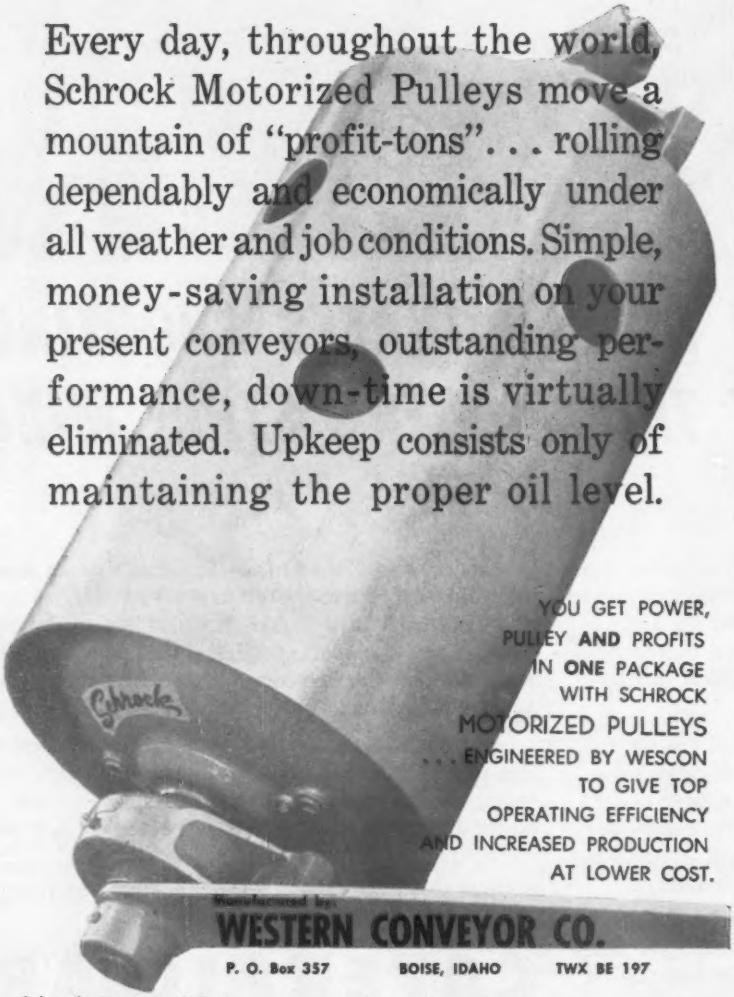

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Uranium Mills *(Continued)*

with a contract recently executed in the Ambrosia Lake area of New Mexico, the AEC had lumped four interests into one "mine unit" in connection with contract calling for purchase of 500 tpy (1-million lb) of U_3O_8 in the 1962-66 program.

This at least eliminates speculation that "any one mine" would include an entire district. But at the same time, AEC did not limit the designation to a single producing property—but extended it to bring in several interests under the 500 tpy "umbrella."

It is not believed that the commission will have to promulgate any "new rules" in connection with its attitude toward letting the Shirley Basin operators build new mills.

Such permission would result from certain interpretations of past announcements regarding 1962-66 contracting.

However, the commission might come under some criticism from operators who already have had their reserves allocated to somewhat distant mills and will have to face higher haulage costs in the 1962-66 program.

ALASKA

The Lost River Tin Mine on Seward Peninsula is again being offered for sale by the GSA. The property consists of patented lode mining claims, purchase option on additional claims, mill and camp buildings, installed machinery, and equipment and related personal property.

Sealed bids will be received at GSA, Federal Office Bldg., Room 126, Seattle 4, Wash., Sale No. 10PRD-320.

Surveying, sampling and testing has resumed on the molybdenum deposit discovered last year in the Hayes Glacier area, about 80 mi northwest of Anchorage. Exploration of the prospect began as early as possible this year with helicopter lifts into the area even before all the snow melted. The work is being done by Glacier Creek Mining Co. in preparation for a core drilling project this summer. It is reported that several large mining companies are studying the project.

Work started in July on drifting on a vein of gold ore at the Mikade mine in the Chandalar district, according to Eskil Anderson, Spokane, vice president of Little Squaw Mining Co. He said a mine crew has been timbering the portal, ore chute, manyway and raise at the property during the past few weeks. The Little Squaw firm is controlled by Grandview Mines and Metaline Mining & Leasing company, both of Spokane, Wash.

ARIZONA

Hi Jolly Mines Corp. of Tucson has recorded what is reported as the largest

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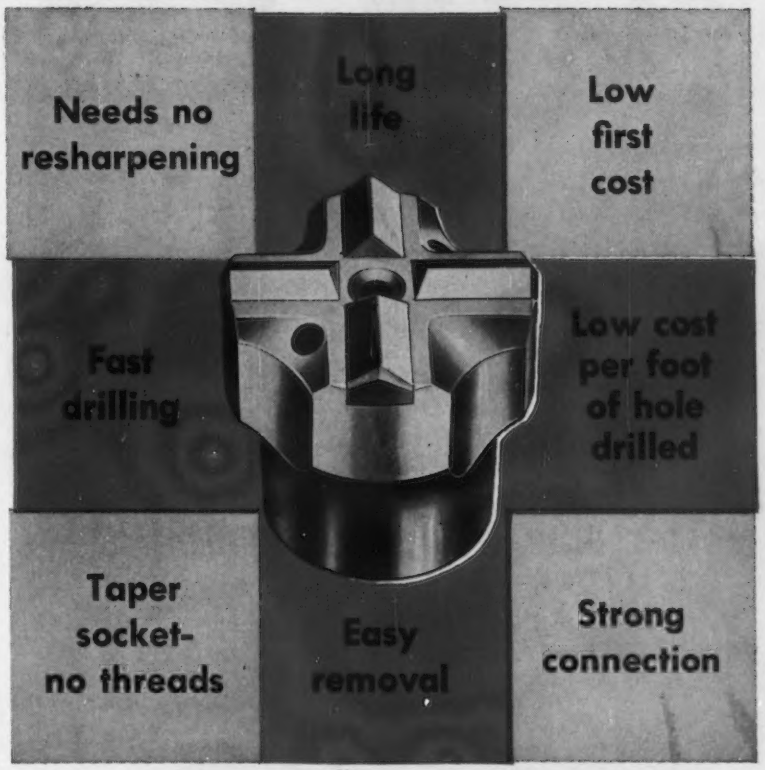

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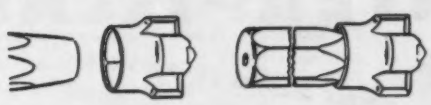

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BEST BUYS IN NEW AND USED EQUIPMENT

Arizona *(Continued)*

group of mining claims—218—ever recorded in Yuma County. Company officials expect to encounter a buried disseminated copper deposit averaging over 1% copper with about $3 in gold-silver per ton. They also believe there are reasonable possibilities of encountering some molybdenum. If the prospects are proved, mining will be by open pit with concentrates being shipped to one of the Arizona smelters. Geological surveys were made by E. Ross Housholder and Ben H. Martin & Associates, who are expected to continue exploration at the site.

Kennecott Copper Corp. has added a 60-100 tpd lime plant to supply "milk of lime" conditioning agent for the flotation at the Ray Concentrator. The construction award has been assigned to Western-Knapp Engineering Co., San Francisco, who also designed and built the $20-million Ray smelter at Hayden. The new lime plant design provides for a wide range of flexibility through five shaft-type vertical kilns to meet the varying feed conditions of the flotation plant. Present lime consumption ranges from 6-10 lb per ton of feed. When less oxidized ore is reached in the Ray pits, the requirements for lime for pH control will likely drop to something like 4-6 lb per ton.

CALIFORNIA

A Bill to validate a sand and gravel mining claim located by William L. Ross has been reported from the Committee on Interior & Insular Affairs by Senator Murray. The committee has recommended that the bill be passed in the Senate—it has already passed the House. Ross located the claims in 1947 after he had been erroneously informed by the Department of the Interior that the lands were open to mining location. At that time a mining location could be made for those minerals, but Section 3 of the act of July 23, 1955 (69 Stat. 367,368), had changed the law in this respect. Consequently, it was not possible for Ross to relocate these mining claims in 1956 even though the land in question was reopened to mining location on Aug. 1, 1956.

The Lucerne Valley Planning Commission has passed a change of zone from light to heavy manufacturing that will enable the Sentinel Mining Corp. to install a $250,000 ore processing plant on 1,440 acres of desert land.

Asbestos Bonding Corp., wholly-owned subsidiary of the Clute Corp., says the first unit of its new asbestos plant at Napa, is under construction and should be completed by Sept. 1.

The new unit, first of four, was scheduled for an input of 250 tpd, but is somewhat over capacity, according to Patrick M. Tabor, president. Total cost of the 1,000-tpd plant is estimated at $1-million.

Meantime, ABC is operating a 60-tpd

pilot mill, incorporating the air separation process which will be used in the new plant.

ABC holds a 99-yr fee lease on 202 acres of property containing the largest known asbestos deposit in the U.S. The mine—the Phoenix—is an open pit operation. The ore is chrysotile.

COLORADO

Fall River Exploration & Mining Co. of Idaho Springs, has negotiated agreements for consolidation of the Argo and Lucania tunnels into one operation. The tunnels, rich producers many years ago, became a joint operation in a long-term lease of the Argo tunnel by Fall River, which has been working the Lucania tunnel for the past 18 months.

Fall River is a closed stock company with some 750 USAF officers as stockholders. The president is Mark Stepelton, an Air Force major and jet pilot who resigned from the service last Sept. to take active direction of the Fall River operations.

The heading of the Lucania tunnel and a lateral of the Argo are separated by about 1,300 ft. Joining the two would involve a cut through a mineralized zone in the Idaho Springs-Central City district. It would permit gravity mining. Linking of the two shafts would also provide adequate ventilation for both workings.

The combined operations give Fall River Exploration & Mining Co. control of more than 880 mine claims. Some of them are in the Russell Gulch, Nevadaville and Central City areas.

IDAHO

Arthur W. Fahrenwald, dean of mines emeritus of the University of Idaho, was honored for his contributions of international significance to the mining industry at the University of Idaho's 1960 commencement exercises at Moscow. He was presented a certificate of merit by University Pres. D. R. Theophilus.

Sixteen men have been put to work at Mackay Exploratory Co.'s copper mine near Mackay. Dave Bell, superintendent, reports that a 100-ton mill will be set up to handle the production.

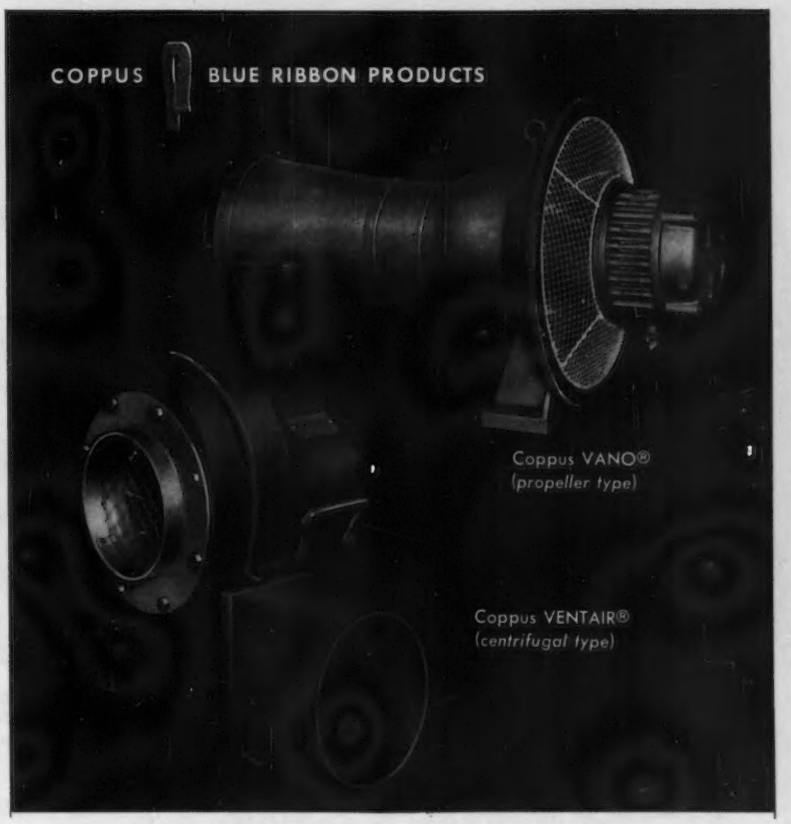
The geological firm of Shenon & Full, Salt Lake City, has been engaged by the Coeur d' Alene Mines Corp. to study the company's property west of Osburn, and to make recommendations for further work at the mine. W. A. Callahan, secretary-treasurer, stated at Wallace, that much promising ground remains to be explored above the site of an exploration project recently completed by the Hecla Mining Co.

The Blackbird Mine of the Calera Mining Co. in Cobalt was closed down this summer and the last of the crew of 40 men was laid off. When government subsidies for the production of cobalt were withdrawn at the end of 1958, a drastic cut in personnel at the mine was made and it has gradually dwindled since. Cobalt was once a community of 1,000.

Construction work on the Bunker Hill Co.'s new $2-million phosphoric acid plant at Kellogg, was completed in June but the plant will not go into operation until the current Mine-Mill union strike against the company is settled. The plant will have a capacity of 130 tpd and will operate on a 24-hr, seven-day week basis when work is started. Dean Wilde of Kellogg will be superintendent in charge of operations.

Idaho Mining & Milling Inc., Lewiston, has acquired all of the plant equipment of Mullin Mines Inc. and will move the equipment to its dredge property in the Florence Basin of Idaho County. Idaho Mining & Milling owns mineral claims on over 40 mi of gold-bearing streambed near the old town of Florence.

Anaconda Co. and J. R. Simplot Co., Pocatello, announce that Simplot has acquired the entire fertilizer plant facilities at Anaconda, Mont.; and has leased Anaconda's phosphate properties at Conda on a long-term basis. Anaconda will operate the phosphoric acid and ammonium phosphate facilities.



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Coppus Blowers for mine ventilation include the centrifugal VENTAIR for long pipe lines and the propeller-type VANO for shorter lines. For a given power consumption both deliver from 30% to 100% more air than an ordinary fan.

Serving as blowers or exhausters they are driven either by electric motor or compressed air, with capacities up to 60,000 CFM. Like all Coppus Products, these blowers carry the same "Blue Ribbon" assurance of quality and dependable performance.

Representatives located in all mining areas. Other Coppus "Blue Ribbon" products: Steam turbines, gas burners, heat killers, air filters, blowers and exhausters for special purposes. See also *Thomas' Register*. Coppus Engineering Corporation, Worcester 10, Mass.

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cuts hauling costs in mines and quarries

Model R-27 has rated payload of 54,000 lbs. and a heaped capacity of 26½ yds. . . . available with Cummins 335 h.p. and GM 336 h.p. engine . . . 4-speed Torqmatic Drive with converter lock-up and Torqmatic Brake . . . dual hydraulic booster steering . . . 18.00 x 25 tires on all wheels . . . rugged body with twin hoists . . . top speed with full payload, 34 mph.

Backed by better than 25 years of specialized experience in building off-highway earthmoving equipment exclusively, Euclid's modern rear-dump line incorporates advanced engineering that is a result of unmatched field experience. From the 10-ton Model R-10 to the big 55-ton "Euc" with two engines and a total of 672 h.p., Euclid Rear-Dumps meet today's requirements for big performance.

This greater dimension . . . in a wide range of capacities, in choice of engines, transmissions, tire sizes, and in type of hauler . . . in the parts and service facilities of Euclid's world-wide dealer organization, too . . . can mean lower hauling costs on mine and quarry work.

EUCLID Division of General Motors, Cleveland 17, Ohio
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A complete line of rear-dumps with payload capacities of 10, 15, 18, 22, 27, 40 and 55 tons . . . also semi-trailer models of 12, 22, 35 and 50-ton capacity.

GM GENERAL MOTORS EUCLID

EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE

MICHIGAN

Calumet & Hecla Inc. produced 15,876 tons of copper in 1959 from its mines in the Calumet area in addition to over 1500 tons from its Tamarack reclamation plant on Torch Lake. Last October a new area in the Calumet conglomerate lode was opened through Osceola shaft No. 13. At the end of 1959, C&H had six northern Michigan shafts in operation.

The Groveland jasper open pit of the Hanna Mining Co., 14 miles north of Iron Mountain, is operating 21 shifts per week with about 170 men. From an average of 4,000 tpd of crude ore, it produces 2,000 tons of concentrates running 60% or better in iron, by magnetic separation and flotation. The Groveland is the only operating mine in that part of Dickinson County. The mine was operated through the 1959-'60 winter and the concentrates were stockpiled.

On June 10 the ICC again suspended the lower rates set up by the C&NW which the Commission had approved April 9. The action was due to renewed protests by the city of Ashland, the Soo Line R.R., Great Northern, Northern Pacific and Duluth, Mesabi & Iron Range railroads. The latter two have no direct interest, but are probably concerned as to the effect a reduction in ore freight rates might have on their own schedules.

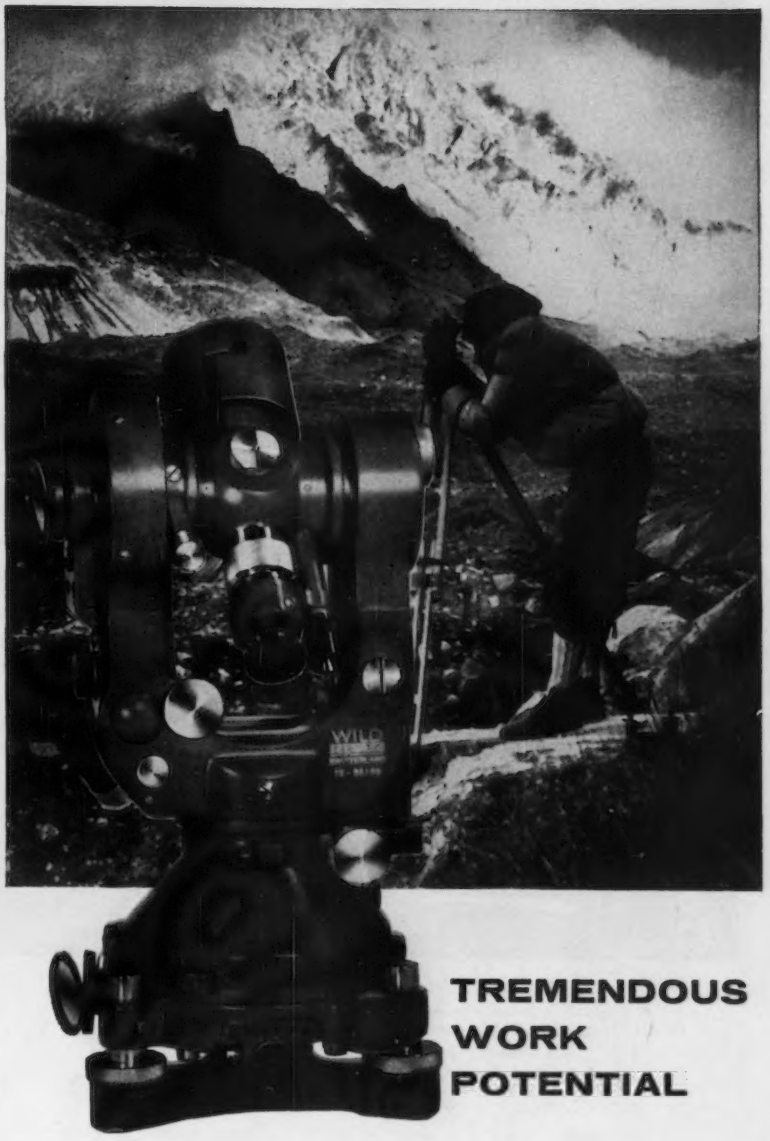
The buildings for serving the new Homer-Wauseca shaft at Mineral Hills in the Iron River district of the Menominee range, have been completed and are in use. They include an electric power substation, office, warehouse and equipment garages, beside loading facilities for rail and truck. A Koepe hoist for the Homer-Wauseca mine is installed in the 130-ft high headframe for the new shaft.

Ore shipped from the Escanaba docks in May of this year established a new record: 1,016,000 tons. The previous record, made in the early 1920s, was 989,432 tons. The 1959 shipments were 833,392 tons. No ore was shipped to the Ashland docks of the C&NW in May 1960. This was due to the lower freight rates to Escanaba from the Gogebic range which had been approved by the ICC over the protest of Ashland. Two Gogebic range mines are shipping through Ashland for part of their production.

MINNESOTA

The Minnesota Ore Division of Jones and Laughlin Steel Corp. has begun work on the stripping of a sizable addition to the Hill-Annex pit at Calumet. It involves the moving of the belt conveyor from pit to surface and of a screening grill that had been in place for many years. A new 6½ yd shovel and six mine trucks are being used on the extension.

Itasca County mine inspector Bernard G. Hurley's annual report for 1959 shows that 36 mines were operated in the county which includes the west Mesabi Range from Keewatin to beyond Grand



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The Wild T-2 enables the operator to work rapidly, precisely and steadily under conditions that may range from equatorial to antarctic.

Optical and mechanical excellence, plus negligible maintenance requirements, combine with a complete list of accessories to make the T-2 the finest instrument in its class by far.

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During 1960 we will ship our 100,000th Wedge-Wire Kleenslot screen.

Call it popularity, call it efficiency, call it good design. Whatever you name it, Wedge-Wire has that vital quality that builds performance into screens and confidence into customers.

Kleenslot preparation screens are designed for vibrators or stationary applications for dewatering, screening, washing, extracting, filtering or sizing applications.

All screens are custom manufactured to your application and are available in many sizes, metals and finishes.

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Minnesota *(Continued)*

Rapids. 7,179,568 tons of ore were shipped, with Oliver's Plummer mine being the largest single producer. Stripping removed amounted to 15,343,176 cu yd, more than two yards of stripping for one ton of ore. M. A. Hanna Co.'s Hunner mine lead in stripping. Some 2,500 men worked 4,288,648 man-hours with no fatal accident.

Cleveland Cliffs Iron Co. is operating the Hawkins mine at Nashwauk, formerly operated by the International Harvester Co., the Hill-Trumbull at Marble, the Holman-Cliffs at Taconite and the Canisteo at Coleraine. All are open pits and all have substantial reserves. All ore produced is beneficiated with plants at each property.

Dravo Corp. of Pittsburgh is constructing two large kilns to be used in roasting non-magnetic semi-taconite for two pilot plants. One—88 ft long by 8½ ft in diameter—for the M. A. Hanna Co. at Cooley will have a capacity of 10 tons per hour. The other, for the Oliver Iron Mining Division at Coleraine, is 50 ft long by 6 ft diameter, capacity two tons per hour. Both kilns will be used to convert crushed non-magnetic semi-taconite into a synthetic magnetic material which will permit magnetic separation of the magnetized iron particles from the waste by conventional magnetic equipment.

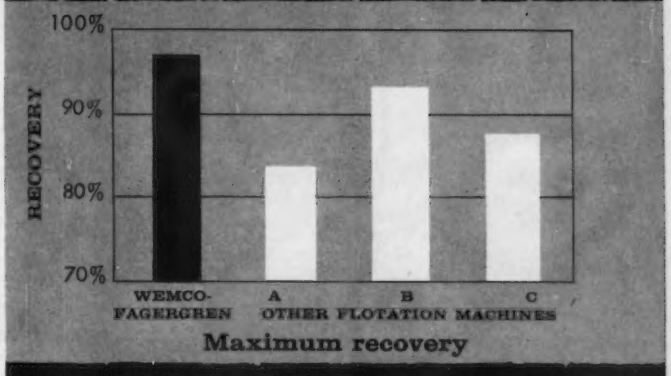
On June 9 Pickands Mather & Co. announced that Everett L. Joppa, general manager of their iron mines in the Lake Superior area, and Donald M. Chisholm, associate general manager, both of Duluth, had been promoted to be partners of Pickands Mather Associates. The same announcement stated that, as of July 1, the firm would begin operating as a corporation instead of a partnership, and the two men were named to its board of directors. The company's name and business will continue as before.

North Range Mining Co. is developing a new open pit mine near Eveleth. It is an extension of the old Leonidas and has been named the Nahma.

The new plant at M. A. Hanna Co.'s Pierce mine in North Hibbing is completed. Trucks deliver the crude ore to a screening and crushing unit in the pit where it is reduced to 5½ in. or under. This unit can handle as much as 1250 tons per hr. The product is carried from the pit by a conveyor belt to a stacker unit which directs it to the plant, surge piles or loading pocket. The plant is designed to permit straight washing, using spirals for the fines; or processed through heavy density and cyclones.

Everett L. Joppa, general manager for Pickands Mather & Co., has announced the closing of the Scranton open pit mine at Hibbing. The mine employed about 140 men. "High grade ore in the Scranton was exhausted some time ago, and when it was clear that we had also exhausted lower grade ores which could be processed into a suitable product able to compete in the present day market, it was decided to close the mine."

GREATER MINERAL RECOVERY WITH WEMCO-FAGERGREN FLOTATION!



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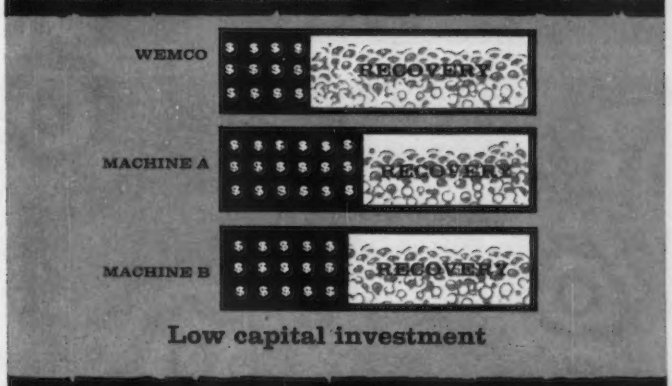
Now, when the high cost of mining is more than ever a prime factor, losses of mineral as tailings must be kept to an absolute minimum.

Look at the record . . . at the results of competitive tests in operating plants! Wemco-Fagergren cells recover a greater percentage of the mineral in the mill feed—consistently! For lowest capital investment, lowest maintenance—highest recovery —look to Wemco, world leader in flotation equipment and the proved answer to more substantial operating profits.



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- *Cuts through clay seams*
- *Loosens cemented deposits*
- *Dislodges large rocks*

No one knows how many tons of material are lost each year in dredging operations because of bad pumping conditions. However, we know that the use of a Van Gorp *Aggretator* has increased pumping time from 5 to 25%, depending on the deposit. We know too, that this increase in production usually pays for the cost of an *Aggretator* within a few months. It's easily installed, has a long productive life, and existing power is sufficient to drive the hydraulic pump. *Write* for details and illustrated brochure on 4 ways to increase your dredging production.

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The ESCO Wear Cap Adapter, winner of the Blue Ribbon Mining Award, is the most rugged tooth assembly ever developed for handling tough rock and taconite. Replaceable wear caps sharply increase service life by protecting the adapter from wear. No special pins or welding required.

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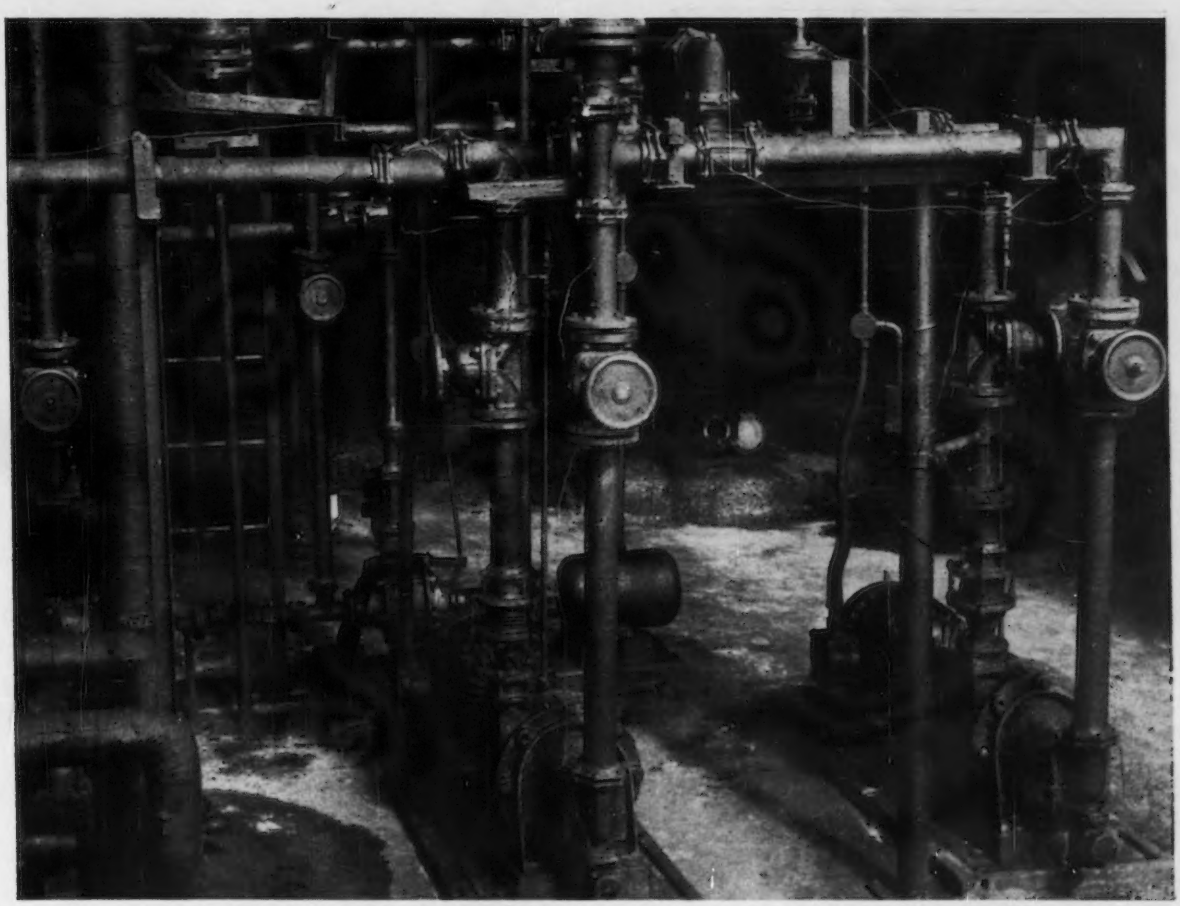


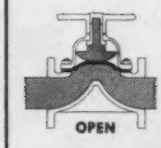
Glass-lined Grinnell-Saunders Valves, with Teflon Diaphragms, on benzene hexachloride lines at Diamond Alkali's Greens Bayou, Texas, plant. Hundreds of other Grinnell Diaphragm Valves are used in other areas of the plant.

How a manufacturer of benzene hexachloride solved a serious valve leakage problem

Valving at Diamond Alkali's Greens Bayou, Texas, plant had become expensive. Leakage of a product containing 30% to 40% benzene and free chlorine released fumes and caused rapid corrosion of the metal parts of the valves used previously, as well as of adjacent equipment.

This problem was corrected when Grinnell-Saunders Diaphragm Valves were used. The first replacement of any part of the Grinnell Valves did not occur for two years, and this was the diaphragm *only*. The former valves had to be *completely* replaced every one to two months! Bodies of the Grinnell valves lasted four years. In short, when Grinnell-Saunders Diaphragm Valves were installed, stem leaks ceased; corrosion was eliminated; and downtime to install new valves was practically ended.

For further facts about Grinnell-Saunders Valves, see Grinnell's insert in Chemical Engineering Catalog, or Sweet's Plant Engineering File — or write directly to Grinnell Company, Providence 1, Rhode Island.



- Diaphragm lifts high for streamline flow in either direction
- Diaphragm presses tightly to effect positive closure
- No packing glands to need attention
- Diaphragm easily replaced without removing valve body from the line
- Wide choice of body, lining and diaphragm materials

GRINNELL-SAUNDERS DIAPHRAGM VALVES

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PIPE FITTINGS • VALVES • PIPE HANGERS • PREFABRICATED PIPING • UNIT HEATERS • PIPING SPECIALTIES

Field Performance Report

Users confirm that DOUBLE GRAY®-X Wire Rope lasts longer on tough jobs

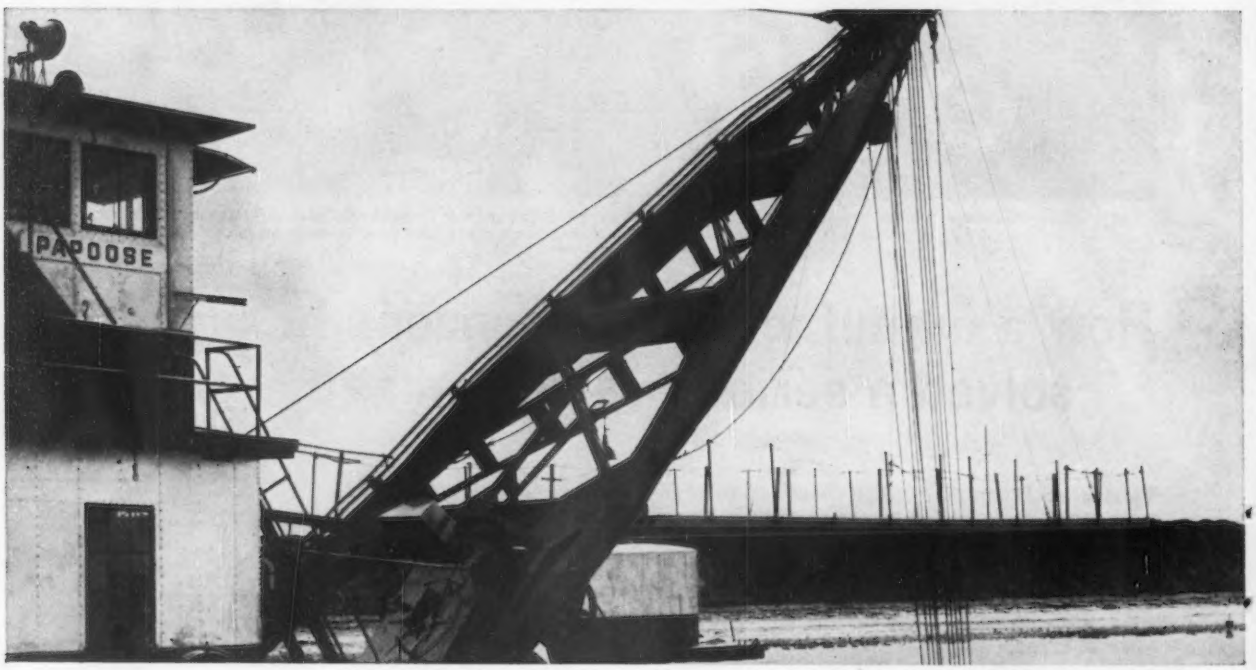
Field reports are now coming through on CF&I-Wickwire's superior new wire rope—Double Gray-X. These reports, a few of which are summarized here, all agree on one point — when the going really gets tough, Double Gray-X lasts longer than other wire ropes.

Double Gray-X is the result of CF&I's intensive research program leading to the discovery of a remarkable new wire-drawing technique. This process includes the use of Molysulfide* in the lubricant, which creates a *permanent molecular shield* around the individual wires, resulting in these benefits:

- **reduced friction between individual wires in every strand of Double Gray-X during service;**
- **smoother wire surface, which helps eliminate the "weak links" that can cause breakage and impair service life;**
- **greater resistance to abrasion, crushing, bending.**

And—in addition to longer life—Double Gray-X gives you extra strength. Made of extra-improved plow steel with an independent wire rope core, this rope gives 15% higher breaking strength than the catalog breaking strength of an improved plow steel rope with IWRC.

Double Gray-X is made in a wide range of sizes and constructions. It's available from CF&I-Wickwire's chain of warehouses and nation-wide network of distributors. For complete details, call the nearest CF&I sales office or a Wickwire Rope distributor.

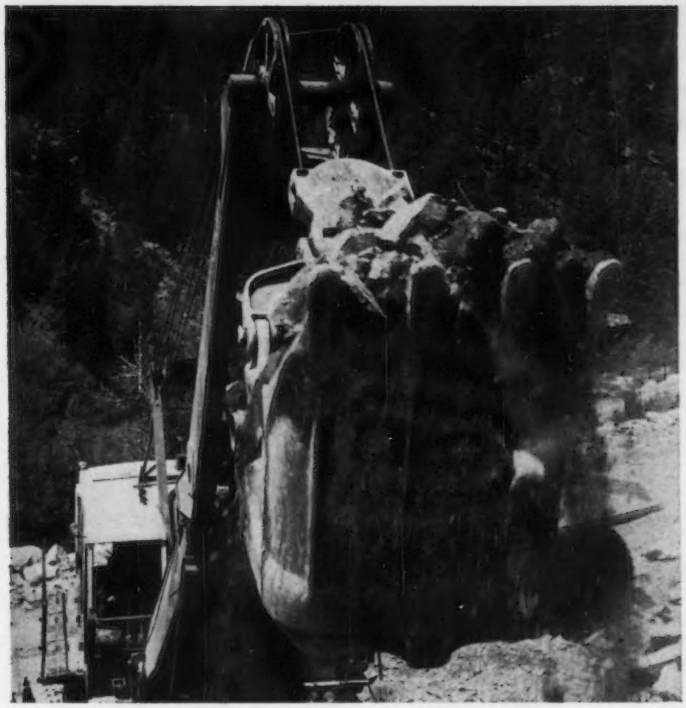


REPORT: ON THE SACRAMENTO RIVER, two dredges – the *Papoose* and the *San Diego*—are sucking up tons of silt to help make Sacramento a seaport. Both use Double Gray-X for lines on swings, spuds and ladders.

Captain Nick Carlson of the *Papoose* (Hydraulic Dredge Company) says: "The Double Gray-X rope that holds the suction head really takes a beating on both spud and swing lines, but it's still in fine shape. However, another brand of wire rope put in at the same time is beginning to show wear."

Captain Ralph Vea of the *San Diego* (Pacific Dredging Company) reports: "When you're down with rope failure in this business, you're really out of production. But Wickwire Rope, which we have been using for nineteen months, really keeps us going. We used to change swing lines every six weeks, but the Double Gray-X we have on there now has been in service nine weeks already. That new protective shield on the rope really does the job."

*Registered Trademark of Climax Molybdenum Co.

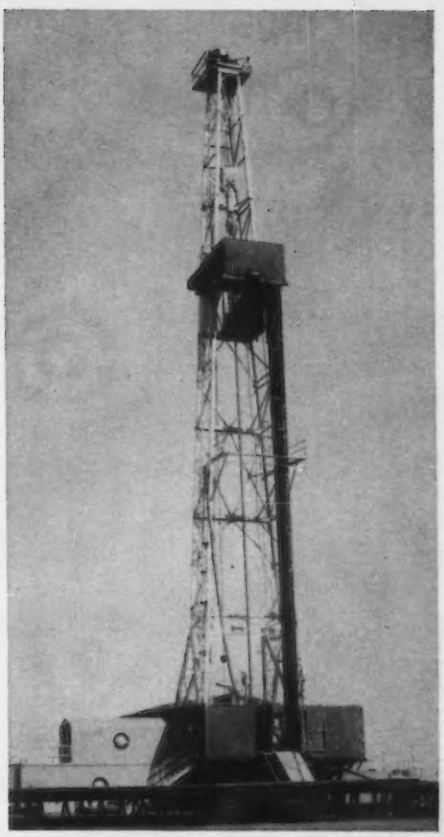


REPORT:

IN THE MOUNTAINS OF COLORADO, the Hopkins Construction Company relied heavily on Double Gray-X on "two of the toughest construction jobs we ever handled." Both required the moving of more than 300,000 cubic yards of material. Many different types of earth-moving equipment, including the power shovel pictured above, were equipped with Double Gray-X — with these results:

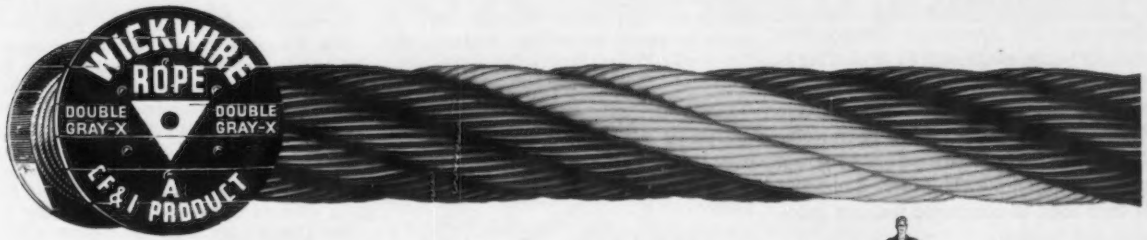
President Hopkins: "Every minute of working time counted on the Cheyenne Mountain job because we faced a $5,000-a-day penalty if we didn't finish it in 45 days. The service we got from Double Gray-X was wonderful. We didn't lose 1% of downtime because of rope failure — and we completed the job in exactly 45 days."

Duane Rundle, Project Superintendent on the South St. Vrain Canyon job: "Rope life has been improved and downtime cut drastically since we switched to Double Gray-X. Maintenance is no problem at all. We just grease the rope when needed."



REPORT:

ON ROTARY OIL RIGS of the Falcon Seaboard Drilling Company, a prototype of Double Gray-X underwent tests that put wire rope to the most extreme abuse. Mr. Jack Starr, Vice President in Charge of Drilling, comments: "The results obtained with the original prototype of Double Gray-X led to our decision to order a carload of this improved product. Falcon Seaboard insists on the best products to serve the oil industry in accordance with today's modern standards."



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In the West: **THE COLORADO FUEL AND IRON CORPORATION** — Albuquerque • Amarillo • Billings • Boise • Butte Denver • El Paso • Farmington (N. M.) • Ft. Worth • Houston • Kansas City • Lincoln • Los Angeles • Oakland Odessa (Tex.) • Oklahoma City • Phoenix • Portland • Pueblo • Salt Lake City • San Francisco • San Leandro Seattle • Spokane • Tulsa • Wichita

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Sturtevant Air Separators make possible highly efficient closed-circuit systems. Large circulating loads increase output, eliminate overgrinding. Ball and lining life lengthens, power costs are lowered. Top quality cement results from precise control of finenesses. Standard 16 ft. Sturtevants deliver raw fines up to 70 tph, finished fines up to 260 bph.

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Sturtevant Air Separators classify sand without water, clean sand by de-dusting it. Pre-classification by air can also increase screening production by removing screen-blinding fines. In blending operations, Sturtevants select desired fines from grinder throughput. This graded product is then used to overcome fineness modulus deficiencies.

Send for Air Separator Bulletin No. 087.

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MILL COMPANY
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Crushers • Grinders • Micron-Grinders • Separators
Blenders • Granulators • Conveyors • Elevators

MISSISSIPPI

Plans for construction of a $5-million electrolytic manganese metal manufacturing plant at Aberdeen have been announced by Peter Colefax, president of American Potash & Chemical Corporation. The plant will have an initial capacity of 5,000 tons per year and will be laid out to provide for further expansions.

Final design and engineering is now in progress, and field construction is scheduled for fall at the company's 1,600 acre site on the Tombigbee River seven miles outside of Aberdeen, with completion planned for late 1961. The new facility will be located adjacent to the company's sodium chlorate plant, which was completed early in 1959 and is currently undergoing a 50% expansion.

American Metal Climax Inc. will construct a new $7-million plant in Vicksburg, to produce nitrate of potash and chlorine, Frank Coolbaugh, president, announced.

The plant will be operated by Southwest Potash Corp., a division of American Metal Climax Inc.

According to Thomas W. Childs, president of Southwest Potash, a new process, under development for five years and pilot-plant tested in association with Jacobs Engineering Co. and the Colorado School of Mines Research Foundation at Golden, Colo., will be used, with operations to begin in October 1961.

NEVADA

Hercules Mines Co. has reopened the Union Mine near Austin, one of Lander County's famous silver producers of the last century. The company purchased the property outright and made immediate plans to get equipment on the ground and start clearing the shaft. Henry Caulfield and Hugh Cameron are in charge of the work. The Union was formerly owned by the Phelps Stokes interests and records show that some of its ore was averaging 1,000 oz of silver per ton at the time it was shut down. The closure was ordered by former Nevada Governor Tasker Oddie who had discovered that the mine was being "milked" extensively by one of the officials in charge of the work. Phelps Stokes later obtained judgment against the official in the amount of $250,000, but the mine was never reopened. At the time of the closing, Oddie declared that the faces of ore were still standing, and later reports indicate that the Union can be worked at a profit.

Fire destroyed the assay office and change room at the historic Dayton Mine and Mill in Gold Canyon near Silver City during June. Firemen from Silver City and Virginia City were unable to control the blaze, origin of which was not determined.

Argentum Mining Co., which recently started operating its new mill in Esmeralda County, is constructing a new lime producing plant at the site on the north edge of Columbus Flat. The installation is designed to produce 20 tpd of high calcium metallurgical grade lime for use in the mill. Surplus will be placed on the open market. Ample limestone in the area has been located to supply the raw material. The leaching process, worked out by James Goldworthy, mining engineer and general superintendent for the firm, will use a new type of furnace designed by John Vobert, of Hawthorne.

The Argentum Co. during June installed a large crusher plant at its mill, capable of handling 500 tph. The mill is Nevada's largest precious metal treatment plant, and is now handling 1,200 tpd of silver ore from the Candelaria mining district. Plans call for handling 5,000 tpd in the near future, and a stockpile of more than 100,000 tons is now ready for treatment.

Production of ore is proceeding steadily from an open pit on the side of Mt. Diablo where values average 10 oz of silver per ton, and from the nearby Alpha T pit from which ore averages $8 per ton. While the mill is situated in Esmeralda County, both mines are over the line in Mineral County.

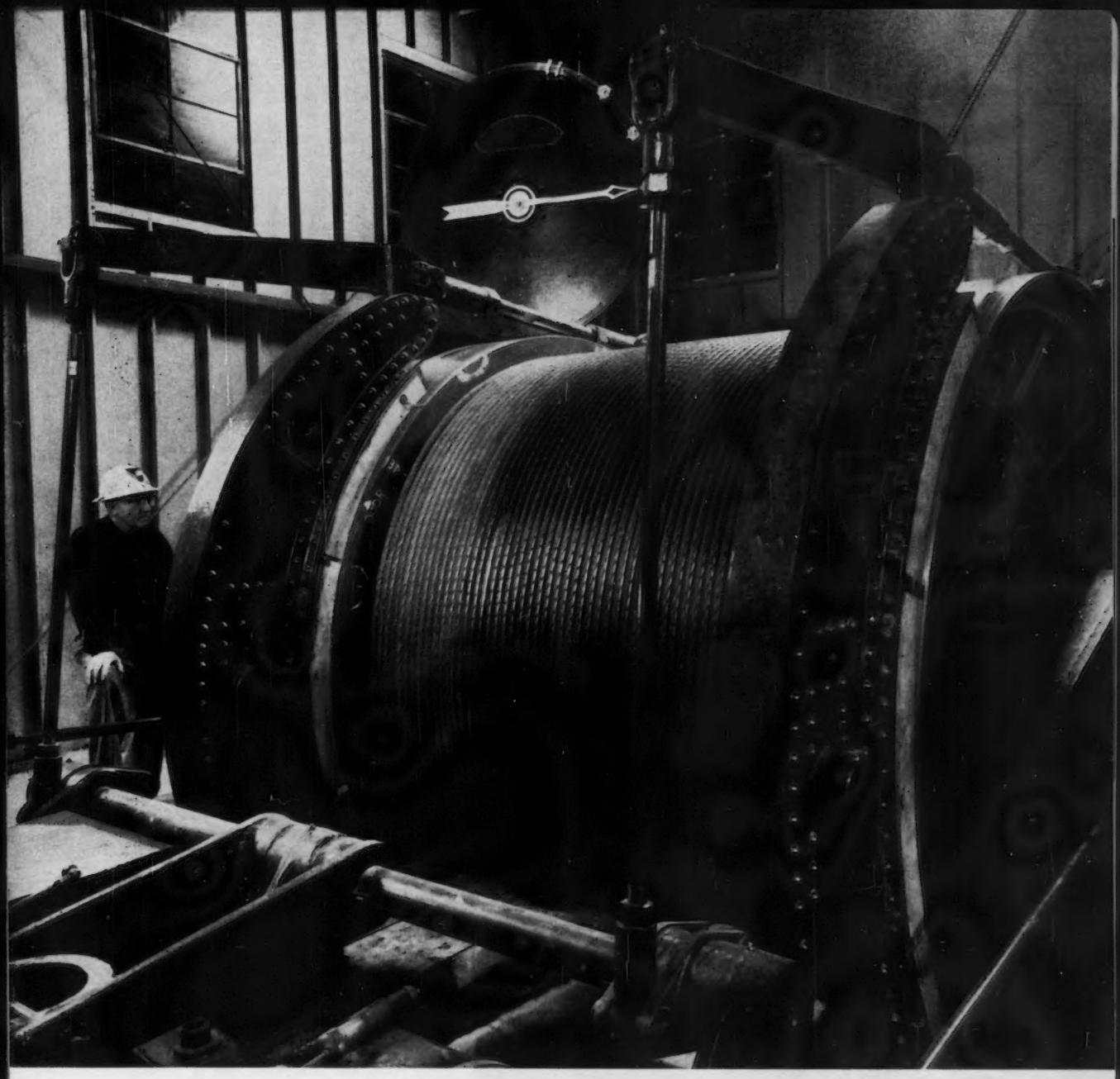
Anaconda Co. has started work on a $6-million addition to its copper refining plant at Weed Heights near Yerington. A. E. Millar, general manager, said work will be carried on steadily and completion of the new facilities is scheduled for the fall of 1961.

The present plant at Weed Heights is designed to beneficiate only acid-soluble copper ore. By the fall of 1961 it is expected that large tonnages of sulphide ore will be encountered in the open pit, and this will require a different method of treatment. Crushing equipment in use at the existing plant will be used for both types of ore.

The new plant will include equipment to grind the ore to a fine screen. There will also be flotation facilities, filtering and drying equipment, and storage space for coarse and fine ore as well as for shipment of concentrates. The new mill will be designed to handle 5,000 tpd.

Consolidated Mines Inc., a new Nevada company, was organized at Tonopah early in June and has started exploration and development of the Mexican Mine six miles northwest of Alkali Springs in Nye County's Lone Mountain district. Work is under the direction of Vic L. Smith, Nevada mining man, who says assays at the Mexican have been encouraging. Values are in silver and copper. A road to the site has been completed and equipment has been moved in. The company has also taken options on the Clifford Mine and Spanish Mine in the Liberty district; the Yellow Gold group in the Cloverdale area, and the Black Top claims near Fraser's Well. All the properties are in Nye County.

W. F. King and associates, of Las Vegas, have launched an extensive gold placering operation in the Johnnie district of Nye County. Location work has been completed on 679 placer claims of 160 acres each. Water has been piped to the site and a washing plant has been constructed.



Bethlehem Rope Gets Workout in Mine Shaft. Here's a drum of wire rope that's giving a good account of itself. It's a 1½-in. Bethlehem line, photographed after it had experienced strenuous service for several months in a 19-ft-diameter shaft in a mid-continent mine. As you can see, the rope appears to be in excellent condition.

You'll find Bethlehem Wire Rope a willing worker in scores of applications in and about the mine. It's as dependable as the day is long, and can be counted on to lift tremendous tonnages.

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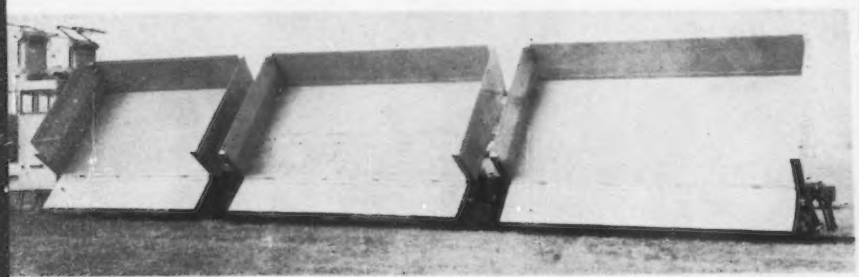

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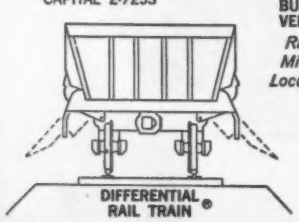
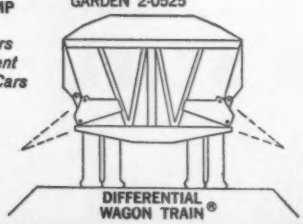


PATENTED



MONTANA

Members of the Beaverhead-Madison County Mining Assn. plan to organize the smaller mine operators and prospectors of Madison, Beaverhead and Jefferson Counties into a joint organization to be known as the Southwestern Montana Mining Assn.

The new organization offers a practical method of bringing small mine operators and prospectors into an organization to represent their own particular interests. It was indicated that it is becoming increasingly difficult for the small, individual operator to resolve his own specific problems, such as the right to take and hold claims on forest and government lands. Representation by an association would be of benefit to the individual in presenting his problems before various federal and state agencies.

"Con Kelley Mountain" has been approved by the Board on Geographic Names as the name of a 7,000 ft mountain in the Flathead National Forest. The name was proposed in 1957 by F. J. Neitzling, supervisor of Flathead National Forest, to honor Cornelius J. Kelley, former president and chairman of the board of the Anaconda Co., who died in 1957.

During the Anaconda Co.'s annual stockholders meeting held in Anaconda on May 18, the stockholders approved a proposal to increase the number of directors from nine to ten and elected directors for a three year term.

Clyde Weed, chairman of the Board, in his talk said that several hundred million dollars more could be added to the $1,214,000,000 spent by the company in Montana in the period 1939 to 1959 if the company included its aluminum and fabricating operations in the state. He reported that since 1947 more than $86-million of capital (for plants and improvements), had been expended in Butte, Anaconda, Great Falls and East Helena operations alone, and about an equal amount in other company enterprises in the state.

Vincent D. Perry, vice president and chief geologist for the company pointed out that if production costs can be stabilized and controlled and a reasonable price for copper maintained, then a new engineering plan will place Butte where it belongs as one of the great sources for the future copper supply of the United States.

Perry said, "The Butte District is one of Anaconda's most valuable resources in the United States. The Butte district is unique among the great copper camps of the world in two ways: First, it has an unparalleled variety of metals in addition to copper to provide flexibility under variable market conditions, and also useful credit to help defray over-all production costs; and second, it combines vast resources of low grade with a complex of high grade veins that have been responsible for its past production. Ore from these many great veins has been supplemented in remarkable degree by the discovery of blind veins with new ore shoots, both laterally and at depth."

"EIMCO IS THE ONLY MACHINE THAT WILL DO THE JOB"...

Says Contractor Holloway

That's sub-contractor H. Holloway, who specified this Eimco 105 Excavator, owned by George M. Brewster and Son of Bogota, N. J., prime contractor, for construction of a 900 foot x 17 foot diversion tunnel.
The project is an earth fill, rock faced dam to control the flow of Kettle Creek, Pa. The tunnel diverts Kettle Creek during construction and, upon completion, will be used to control flood waters, along with the dam spillway.
Advancement to date has been over 635 feet.
The Eimco 105 Excavator is used to muck out each round in the tunnel. Two shifts a day each complete two 9 foot rounds of drilling, blasting and mucking
Two Koehring trucks take the muck out to the dam face, where it is dumped and later distributed to proper thickness.

THE EIMCO EXCAVATOR LOADS EACH TRUCK IN ONLY 45 SECONDS. THERE IS NO STANDBY MACHINE, FOR THE SUB-CONTRACTOR HAS EXPERIENCED THE DEPENDABILITY OF THIS TRACTOR-EXCAVATOR AND THE MINIMUM DOWN TIME IT REQUIRES.
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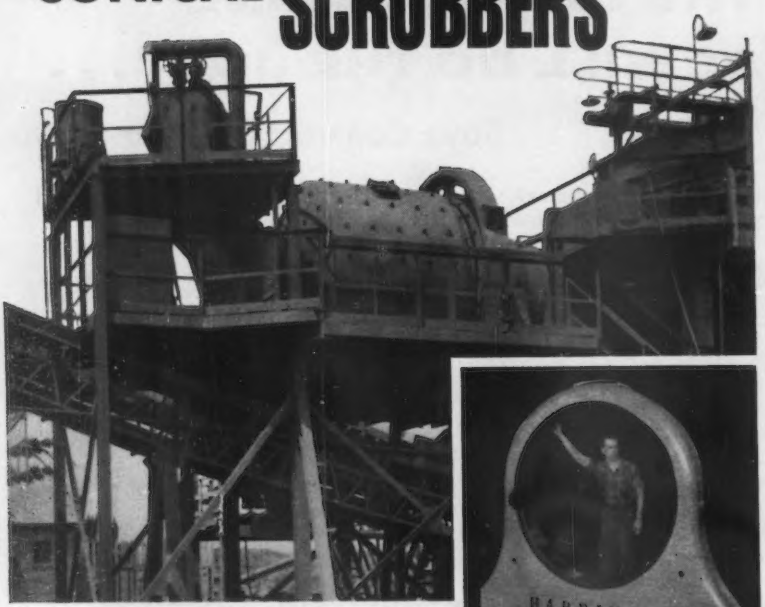

A 10' diameter by 84" long Hardinge Conical Scrubber scrubbing 5" iron ore.

A Hardinge Scrubber bearing—inside diameter 60".

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NEW YORK

Ground has been broken for new breaking, screening and cooling facilities for the sinter plant at the New York Ore Div. of Jones & Laughlin Steel Corp., it was announced by R. Grant Fleck, J&L's New York Ore Div. manager.

The new facilities, which are being installed by Dravo Corp., Pittsburgh, include a vertical shaft stationary cooler—the first of this type to be installed in the United States. Capacity of the new unit will be 3,800 tpd.

NORTH CAROLINA

Cranberry Magnetite Corp., Cranberry, now is producing about 100 tpd of iron ore in operations spanning the North Carolina-Tennessee mountains, reports N. T. Dixon, head of the project.

Ore from the mines, now being stockpiled near Cranberry, will be converted into sponge iron and high grade steel. Plans announced earlier this summer call for construction of a $4-million electric melting furnace to be built in Carter County, Tenn., within the next nine months.

The Carolina Perlite Co. plant at Old Hill was gutted by fire July 11. The blaze, which destroyed about half of the building, caused great water damage to perlite ore and some finished products. It was believed to have started from an electric motor.

OHIO

A 20% increase in the production capacity of "Elmang" electrolytic manganese metal has been announced by Union Carbide Metals Co., to meet increased demand for this alloying metal. The expansion was accomplished with the installation of additional cells at the company's Marietta plant.

TENNESSEE

Joy Manufacturing Co., through their contract drilling division, now has 10 diamond drills operating in the East Tennessee zinc district. Most of these drills are operating on a two-shift basis.

Tri-State Zinc Co. is completing a diamond drilling program to determine the extent of ore on their west New Market, Jefferson County, zinc property. If the project is successful, a mill will be erected on the property to handle 3,600 tpd of ore.

UTAH

Continental Materials Corp., Chicago, has acquired 50% of the shares of Yale Gold Mining Co., a Salt Lake firm exploring for silver-gold in the Midas area of Elko County, Nev. Yale had been jointly

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When your yearly mining requirements are for many millions of tons of one of the hardest rocks known to man, you need—and expect—long-life dependability from your loading equipment.

Ten Marion 151-M shovels are delivering just such dependability in this taconite operation on the Range.

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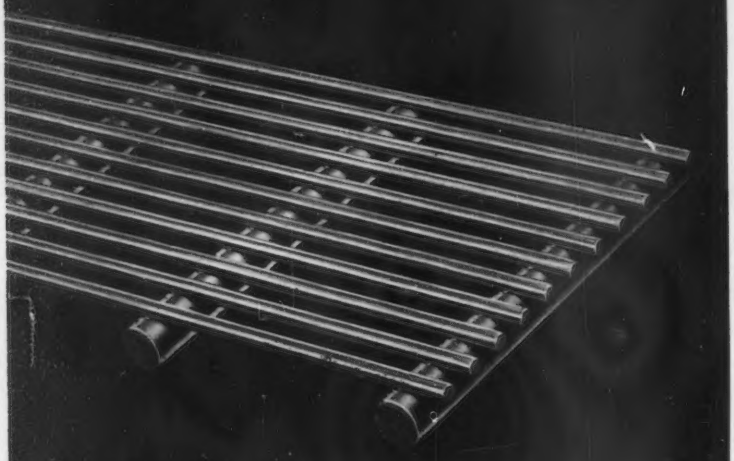

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Utah *(Continued)*

owned by New Park Mining Co. and East Utah Mining Co., Cranmer-related firms of Salt Lake City.

W. H. H. Cranmer, president of Yale and other New Park, said that $100,000 would be placed in exploration of the Elko Prince and Miners Gold (adjacent) properties as a result of the Continental Materials acquisition of Yale Gold stock. The transaction involves about 22 claims leased by Yale from Elko Prince, an historic gold producer in the district 50 mi due north of Elko.

Bids were to be opened late last month by the AEC for the proposed purchase and removal of "Government-owned equipment" at the former AEC uranium ore-buying station and sampler at Moab.

The property consists of buildings, ore dumps, crushing equipment, conveyors, dust control equipment, grizzly feeders, vibrators, ore dryers and auxiliary equipment. The Moab buying station went on stand-by when Uranium Reduction Co. opened its mill in November 1956.

Kennecott's Utah Copper Div. has installed a 10 x 16 ft rod mill on a test basis at the company's Arthur mill site.

It is expected that the rod mill will be under test conditions for about a year. Should the results prove satisfactory, it is probable that rod mills will be installed to replace the present rolls, company officials said.

The rod mill, with some 114 tons of 16-ft, 3-in. dia steel rods, is installed in the concentrator circuit between the earlier crushing operations and the fine grinding step. At the present time, it is handling about 3,700 tpd of ore. The concentrators at the Utah division are currently treating about 90,000 tpd of ore.

Due to problems involved in breaking the coarse ore received from the mine at Bingham Canyon, more efficient and economical means of crushing and grinding have long been sought by the company.

New Park Mining Co. has been fined $1 and court costs of $634 in a judgment entered in Federal District Court at Salt Lake City as outgrowth of the company changing to a lease system of operation at its Park City district lead-silver-zinc producer.

The court found that the company had closed down in good faith to avoid added losses. Had the firm continued the close down, however, and not reopened under the lease system, it would have suffered losses of more than $100,000 and impairment of an $800,000 exploration program in which the Defense Minerals Exploration Administration is now participating.

Marvel Mining Co., Salt Lake City, has made a high grade discovery of lead-silver oxide ore in the Clifton mining district in western Tooele County.

J. A. Minton, Marvel president, termed the find "only a prospect" at present. Marvel is 48½% controlled by English Oil Co., a Salt Lake independent oil producer company of which Minton is chairman.

Minton confirmed that Marvel had made shipments from ore ripped and

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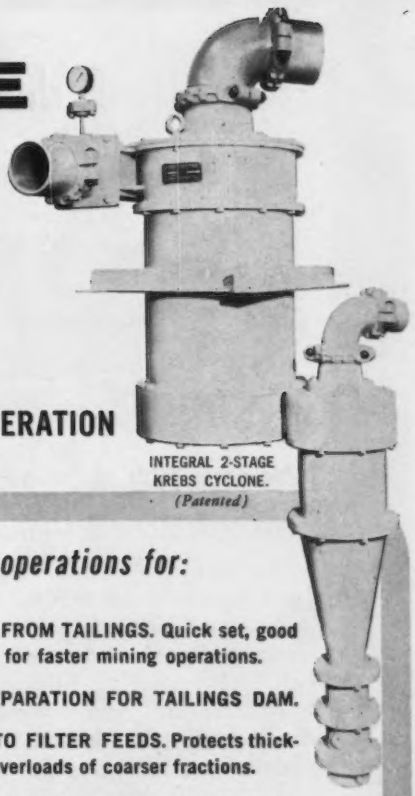

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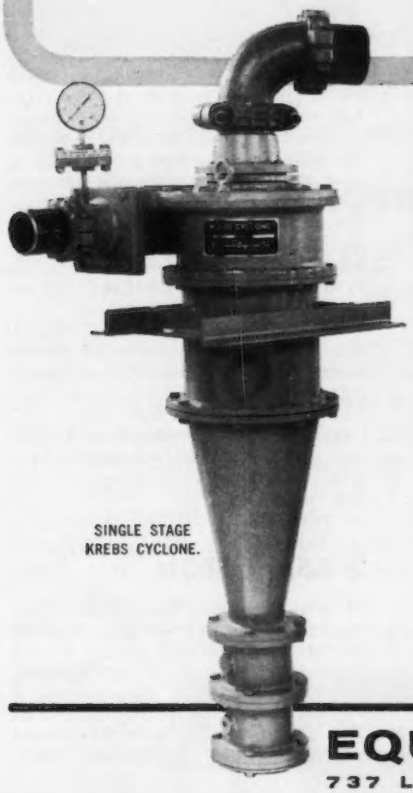
- BERM PREPARATION FOR TAILINGS DAM.
- ADJUNCT TO FILTER FEEDS. Protects thickener from overloads of coarser fractions.
- DESANDING MINE WATER. Reduces pumping maintenance substantially.
- OTHER SPECIAL APPLICATIONS.



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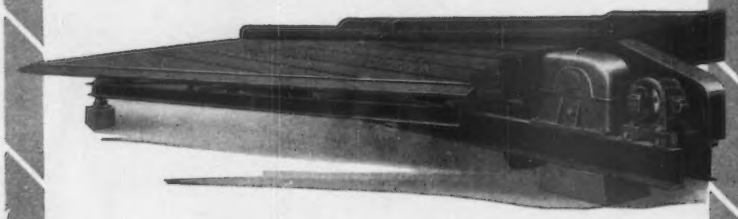

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Utah *(Continued)*

bulldozed from some of 75 claims in the district. The shipments to the Tooele smelter of International Smelting & Refining Co. average $50 a ton, he said.

The discovery in the historic district is in an area heretofore not developed in years past. Minton said that a fissure of undetermined size and extent had been laid bare by utilization of earth-moving equipment. It will require underground mining.

Three Salt Lake prospectors report another discovery of beryllium.

Paul, Daniel and Samuel Mertins report location of an outcrop of beryllium ore in form of both crystals and apparently in rock of quartzitic character with the beryllium minerals in disseminated form.

The brothers have obtained a 160 acre lease on the east side of Mt. Baldy, west of Calio, near the Utah-Nevada border.

A newly patented ion-exchange process simplifies the extraction of rhenium compounds or metal, which has heretofore been an expensive and complex matter involving chemical decomposition and selective crystallization.

Dilute contaminated rhenium-bearing solutions are passed through an ion-exchange resin column. The resin retains the rhenium, and the solution carries off the impurities. When the resin is saturated, it is water-rinsed to remove soluble impurities, then is eluted; later precipitation of the rhenium from the eluate solution produces a product of 99.99% purity. The resin is re-used.

Rhenium, a very rare element (its estimated concentration in the earth's crust is one part in a billion), has a very high melting point, 5,800° F. Only tungsten and carbon are higher. The metal might be used in electrical contact points, in electronic tube filaments, as a catalyst in the chemical industries, etc. Very little has been produced up to now, mainly for experimental purposes.

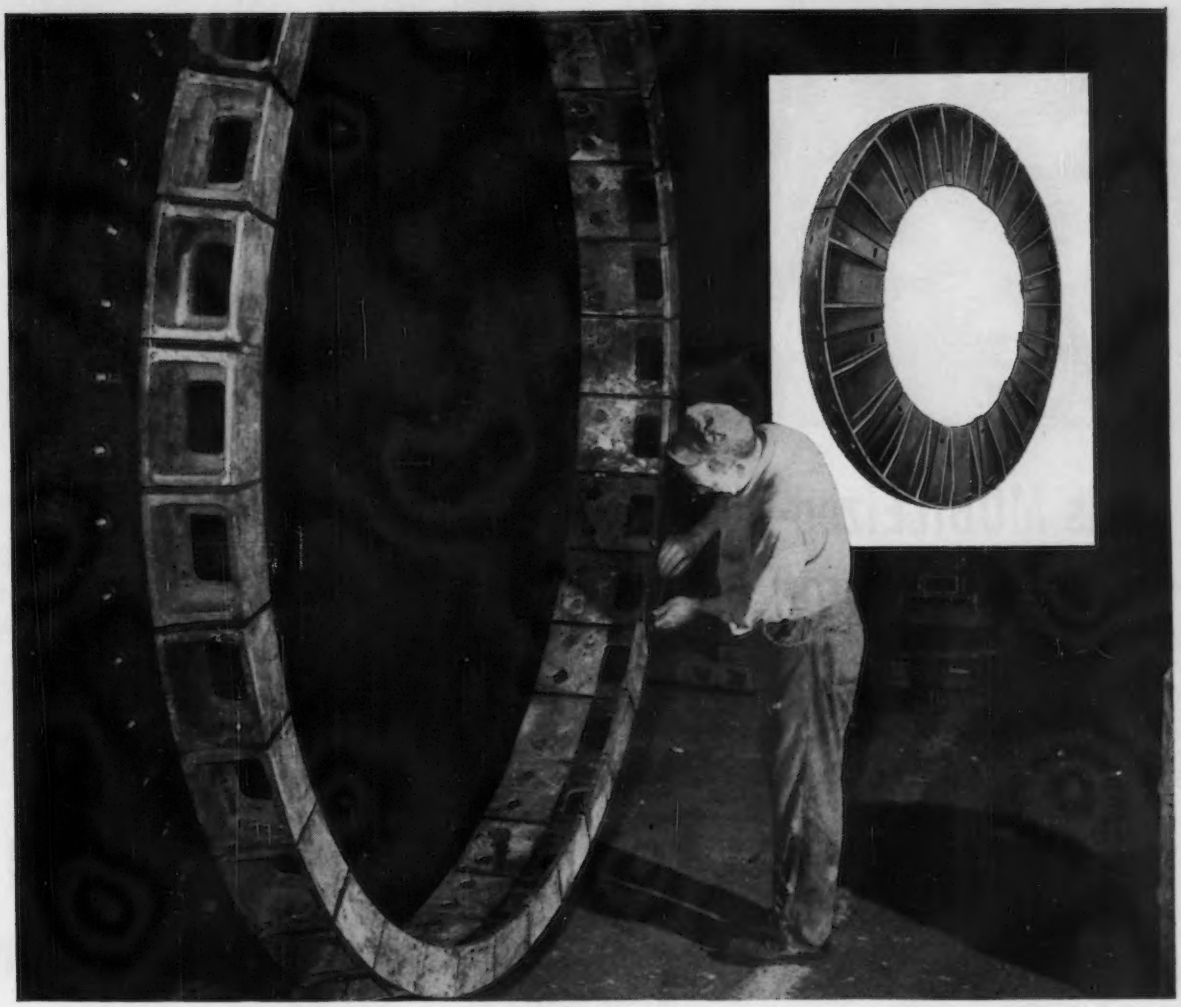
The U.S. Patent Office granted patent no. 2,945,743 for this process to Kennecott Copper Corp., two of whose scientists, S. R. Zimmerley and J. D. Prater, both of the Salt Lake City research center, developed it.

Another recent patent, no. 2,945,742, was awarded to Kennecott for a new solvent-extraction system for producing pure thorium dioxide from impure thorium leach liquors. Prater and C. C. Christensen did the research work. Thorium is a more abundant element than uranium, and has potential use as a nuclear reactor fuel.

WASHINGTON

Daybreak Uranium Inc., Spokane, has acquired a part interest in a tungsten property at Silver Hill, site of an old tin mine, about five mi south of Spokane.

Development work has exposed a number of tungsten veins ranging from three to 10 ft wide in a mineralized zone that is 2,000 ft long and 500 ft wide.



IN CEMENT, LIME, AND DOLOMITE PLANTS...

B&W Nose and Tail-Ring Castings Demonstrate Longer Continuous Service

Longer brick life and longer continuous service are being attained by 275 kilns in 54 plants using B&W Nose and Tail-Ring Castings. In many cases, the life of these castings has exceeded 9 years.

Light and strong B&W Alloy Castings have improved kiln performance in most installations. Made of heat-resisting Grade HH alloy, nose ring castings eliminate belling out of the kiln shell, assuring longer brick life and longer continuous operation of the kiln. By protecting the end of the kiln shell from direct flame, the nose ring castings prevent "feathering-down" of the shell because of oxidation. Their design eliminates cracking and warping, experienced with large size castings.

Small size and light weight make B&W Castings easy and inexpensive to install. The protecting flange on the nose ring castings permits the use of low-alloy steel bolts for fastening.

Spare part inventory may be kept low because the same nose ring castings may be used on kilns varying up to 4 feet in diameter, depending upon size. Write for Bulletin S-17. The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

B&W

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S-467

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Washington *(Continued)*

Officials expect to construct a 50-ton gravity type concentrator at the site. At present, fine ore from shaker screen operation has been concentrated in a pilot plant operation in Spokane.

Construction of a $500,000 high quality silica sand plant is under way on a 25 acre site near Valley, by Lane Mountain Silica Co.

Northwestern Glass Co. of Seattle and Del Monte Properties Co. of Pebble Beach, Calif., own about 70% of Lane Mt.

The processing plant will be a modern ore beneficiation works, utilizing crushing of pit run material, milling, flotation, filtering and drying, to produce an exceptionally high grade silica product.

Geologists of Washington State University have set up headquarters in the Box Canyon area near Ione to conduct a survey of Pend Oreille County mineral resources.

The survey work will be conducted under the direction of James W. Crosby, chief geologist for the WSU Division of Industrial Research, and Richard Cavin, a member of the staff.

The WSU group will make initial soil tests in the Metaline mining district where findings can be correlated with ore deposits which have been proven by diamond drilling. The work is being financed by a $5,000 grant from the Pend Oreille County Public Utility District at Newport, and a $2,000 grant from Diamond National Corp.

WISCONSIN

Reserve Mining Co. plans to spend more than $120-million to double the size of its taconite mining operations in northern Minnesota, according to Robert J. Linney, company president (E&MJ, June, p 21). The firm's present investment at Babbit and Silver Bay, Minn., is estimated at $190-million.

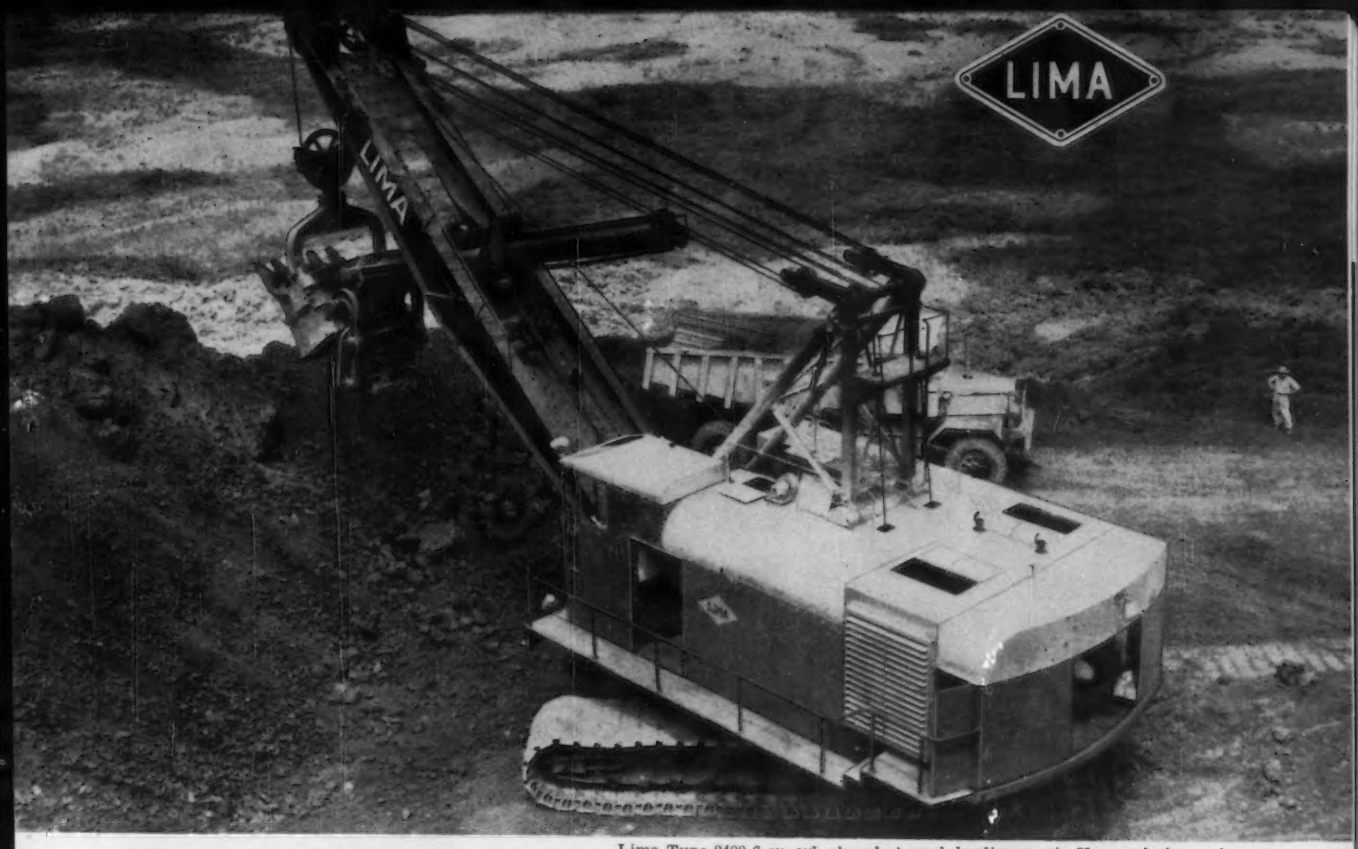
Linney asked the Minnesota Water Pollution Control Commission to hold a hearing on granting Reserve Mining permission to increase the water intake at its two taconite operations from 260,000 to 500,000 gpm. The water would, as at present, be taken from Lake Superior.

WYOMING

First stripping for an open-pit uranium mine in the Shirley Basin got under way early in July with the awarding of a $500,000 contract for the stripping operation to the Plateau Construction Co. of Rawlins, by Tidewater, Skelly and Getty Oil Companies, joint owners of the property.

More than 2.3-million cu yd of overburden will be removed in the initial stripping, which will open an extensive orebody. Production of the ore is slated for late fall.

The TSG No. 1 pit is 2½ mi south of the underground mine of the Utah Con-



Lima Type 2400 6-cu. yd. shovel at work loading ore in Venezuela iron mine.

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Quality does pay off. As hundreds of mining operators have found, Lima's extra engineering features and precision construction mean greater tonnages, higher profits.

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Drums are extra wide, with large diameters . . . advantageous when operating as a dragline, crane or high-lift shovel, because of greater cable capacity.

Anti-friction bearings at all important bearing points, including the drums.

Extra-large air-operated clutches respond instantly to the slightest movement of the controls, reducing operator fatigue.

Torque converter increases output, reduces shock loading, prevents engine stall . . . cushioned effect of drive lengthens cable life, lowers machinery maintenance. Standard on Type 2400.

All gears, smaller parts and shafts that are subjected to extra wear are flame or induction hardened for longer life.

There is a Lima for every kind of mining operation. Shovels ½ to 8 cu. yds., cranes to 140 tons and draglines variable. Get full details on these powered-for-profit machines from your nearby Lima distributor, or write to Construction Equipment Division, Baldwin-Lima-Hamilton Corporation, Lima, Ohio.

Lima Type 604 1½-cu. yd. shovel and Lima Type 1201 3-cu. yd. shovel loading iron ore on Mesabi Iron Range.

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with a 10-Yard Cableway DragScraper

At this 400-ft. by 1,000-ft. storage area, ore is reclaimed from an 80-ft. stockpile to two 3,000-ltph. longitudinal conveyor slots. Ore directly over the slots is reclaimed by gravity—all remaining material is handled by a 10-yd. Cableway DragScraper.

Before the Sauerman Machine was installed, ore was moved to the slots by a small fleet of crawler units operating on the ore pile. Steep slopes and great heights made their operation hazardous.

To eliminate this and reduce labor costs, the crawlers were replaced by the Sauerman Cableway DragScraper. Now, no men are needed on the storage pile, and ore may be reclaimed from any point in the area at will. The latter feature is particularly helpful in blending the ore and insures uniform quality.

The Cableway DragScraper consists of two self-propelled towers paralleling the storage. A 10-yd. DragScraper Bucket and carriage ride the track cable suspended between them. Electrically driven drum hoists located in the towers control hauling, hoisting and conveying. Despite its size, the Sauerman unit can be operated by one man.

DragScraper Machines are built in sizes from ⅛ to 15 yds. to handle stockpiled bulk material in both outdoor and indoor storage facilities. Write or call about your requirements. We'll recommend the proper machine for you and forward appropriate literature.

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Wyoming *(Continued)*

struction & Mining Co. It is 33 mi north of Medicine Bow and 62 mi from Casper.

The pit covers an area 600 ft wide and 800 ft long. It will be excavated to a depth of 120 ft to reach the orebody.

Uranium ores of the Shirley Basin have been estimated by the AEC to yield 0.034% uranium oxide—considerably richer than Gas Hills deposits.

Tidewater's uranium division has maintained an office in Casper since 1956, carrying on detailed evaluation of its Shirley Basin deposits. Core drilling has been accomplished over a large area in the basin.

Stauffer Chemical Co. has completed plans to build a major soda ash production facility near Green River. Construction has begun, with completion scheduled for late 1962.

The project involves driving a mining shaft and an air shaft, building a railroad bridge to span the Green River, a railroad spur, highway and a refinery.

The as-mined trona contains some shale and carbonaceous material. Stauffer has developed a process to refine the trona to yield top quality soda ash. Initial capacity of the soda ash refinery will be 150,000 to 200,000 tpd.

OKAY, LET 'ER GO! W. C. Farthington, bulldozer operator from Riverton (left), gets final instructions for earthmoving at Atlantic City from Stanley H. Cohlmeyer, project manager for Columbia-Geneva Steel, and Earl T. Von Geem, Pomeroy-Bechtel. J. A. Buchanan, Wyoming Natural Resource Board, is at right.

Earthmoving operations are under way near Atlantic City for U.S. Steel's taconite project (E&MJ, July, p 26). J. H. Pomeroy & Co. and Bechtel Corp. have been awarded the contract for removing overburden, pouring foundations, creating a reservoir and dams, placement of approximately 5,000 tons of machinery and construction of 77.9 mi of standard gage rail track from the minesite to Winton Junction.

Arthur G. McKee & Co. received the contracts for the agglomeration section at the project. Steel fabrication and erection will be by U.S. Steel's own American Bridge Div. The 4,000-tpd capacity plant will utilize the process developed by McKee and Allis Chalmers Manufacturing Co.

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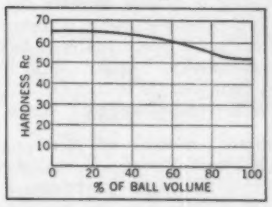

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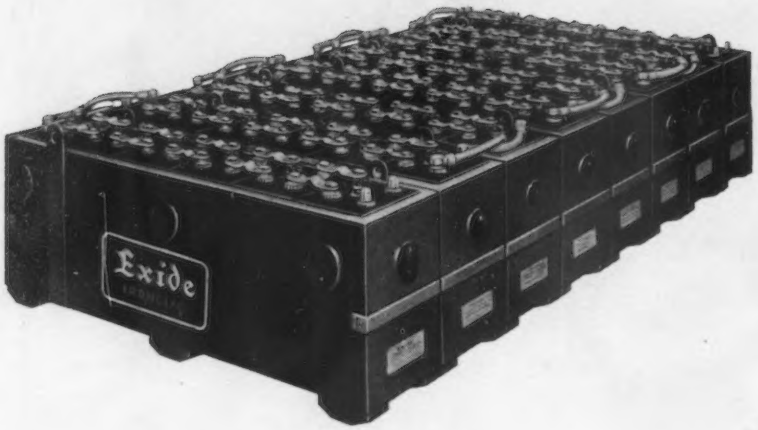
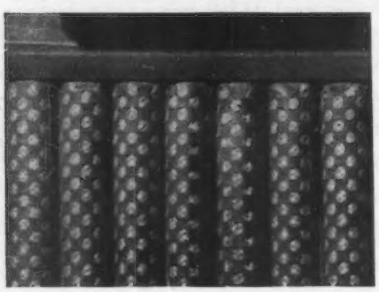


New improved Exide-Ironclad Batteries give you up to 45% more power than the same size battery you may be using now—and longer life as well. Positive plate active material is made more useful by higher porosity tubing—with a corresponding increase in battery capacity and cost economy. As a result, your equipment can pull more tons of load per dollar of battery investment. Exide-Ironclad tubular construction protects the active material from battery-killing vibration and jarring—you get years' longer service life without failure.

The largest work output for the longest time—not purchase price—is the key to true battery economy. So when you need batteries, specify Exide-Ironclad and get the most production capacity your dollars can buy. For details, write Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 20, Pa.



Here's Why—The improved Exide-Ironclad tubular positive plate packs more active material for greater capacity. The armored porous tubing holds the material securely for long battery life, yet permits free access of electrolyte for high power under sustained load.

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IN CANADA

ONTARIO

A shipping magnate and an oil tycoon are joining forces to develop a 10,000-acre tract of potential iron ore property along the north shore of the Saguenay river, in Quebec.

Aristotle Onassis, Greek ship owner, and Paul Getty, multi-millionaire U.S. oilman, are the principals in Commonwealth Getty Mining Co. of Canada, according to Dan Keefe, of New York.

Mr. Keefe describes himself as the "front man" and a director of the company.

Initial development costs will probably reach $3-million, he said.

Preliminary tests indicate at least 20-million tons of ore assaying 47 and 61% iron content, Mr. Keefe says, and will be mined by open pit.

Underground diamond drilling at the copper mine of Temagami Mining Co. has picked up new ore east of the shaft. Initial drilling returned a 5.3-ft section averaging 11.8% copper and a 30-ft section, estimated to have true width of 12 ft, averaging 10% copper. Further drilling is in progress.

Rio Algom Mines, the company formed on amalgamation of Algom Uranium, Milliken Lake, Northspan and Pronto, commenced operations as of July 1. The amalgamating companies were all uranium producers in the Elliot Lake area. The new company is continuing uranium production from the two Algom plants, the Algom and Nordic, from the Milliken Lake mine, and the Panel mine. The Pronto plant is being modified to handle copper ore from the Pater property.

Production operations are getting started at the H. G. Young Mines' Red Lake area gold property. The mine will be the first new gold mine for Ontario since 1949. The company recently purchased the Starrat mill which has been rehabilitated. Mill capacity is around 250 tpd but with little additional expenditure would be capable of treating 500 tpd.

Silver output from the veteran Cobalt area has shown a definite increase this year. Production in the camp is being obtained from seven properties operated by four companies, Agnico Mines, Langis Silver and Cobalt Mining Co, Silver-Miller Mines and Deer Horn Mines.

Alvin Hamilton, minister of Northern Affairs & Natural Resources, has announced the "Canadian participation rule" introduced some time ago with respect to oil and gas leases will be applied to grants of mining rights in federal government land.

The rule is that no one can get a lease who is not a Canadian citizen or a company incorporated in Canada which is either controlled by Canadian citizens or has securities listed on a Canadian exchange and available for purchase by Canadians.

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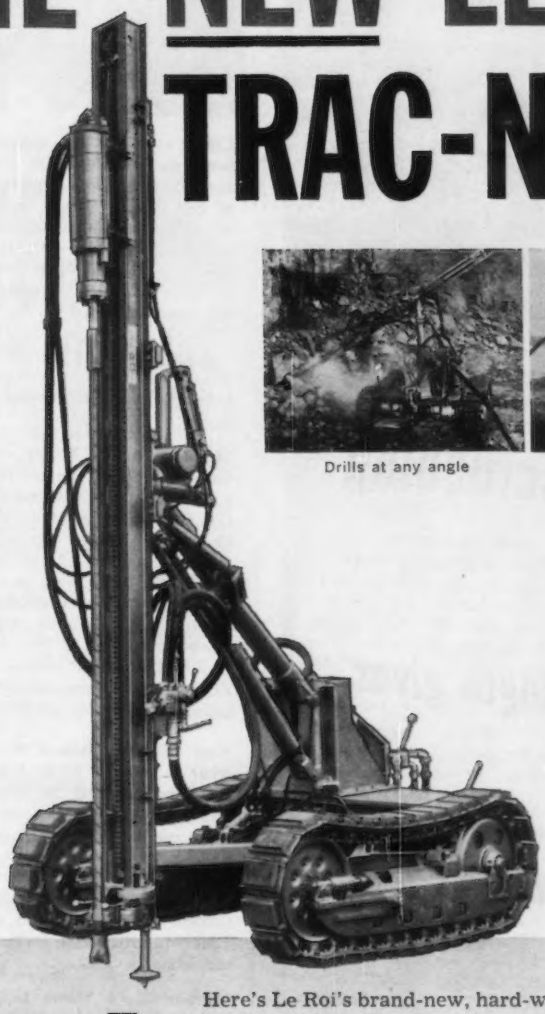

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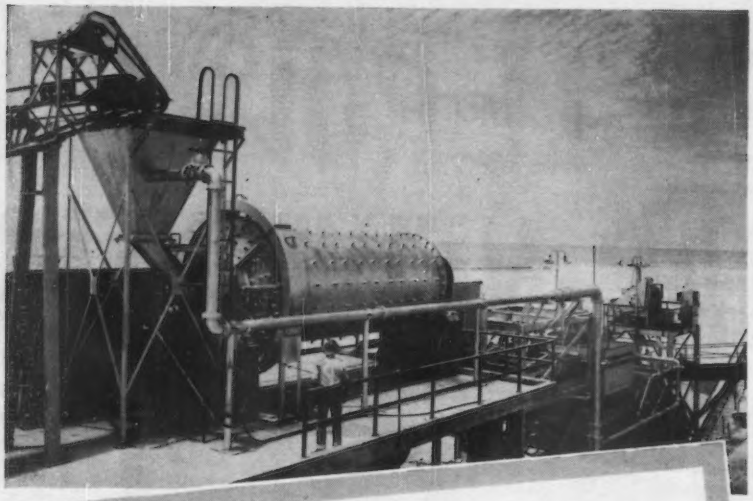

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QUEBEC

The six-compartment shaft at the Mattagami Lake Mines' base metal property in the Mattagami area is now down more than a third of the way to its objective of 1,200 ft. A partial station has been cut on the first level at 150 ft and a second station established at 350 ft. Shaft sinking is expected to be completed before the end of the year.

Coniagas Mines has announced plans to bring its Bachelor Lake area silver-lead-zinc property into production at a rate of 400 tpd by March 31, 1961. Ore reserves to the 650-ft horizon were previously estimated at 407,310 tons averaging 15.7% zinc, 1.04% lead and 8.77 oz silver per ton and a further 60,000 tons has been indicated to the southwest. In 1956-57 a shaft was sunk to 1,350 ft with lateral work carried out on five levels. Additional development work is expected to add to present indicated tonnage.

Manitou-Barvue Mines added substantially to copper ore reserves during the past year at its base metal operation in the Bourlamaque area. This year it is planned to deepen the internal shaft in the zinc section of the mine an additional 500 ft. Drilling in this sector has indicated the zinc orebodies continue in depth. At the end of 1959, copper reserves above the 1,870-ft level amounted to 800,000 tons averaging 1.1% copper. Zinc reserves above the 3,000-ft level totalled 438,200 tons grading 7.1% zinc.

East Malartic Mines has encountered what is believed to be a brand new ore structure at depth in initial lateral exploration well to the east of the main mine on the 19th level. Some 40 holes have been drilled but as yet it is too early to determine extent or grade of the find. The zone is still wide open on extension to the east and vertically. The East Malartic gold mine is located in the Malartic area.

Marban Gold Mines is getting a first look underground at its gold property in the Malartic area. Shaft sinking was completed recently and a crosscut driven out on the 650-ft horizon. Three separate gold-bearing zones have been cut and work is in progress to fully explore the zones. Two crosscuts are also in progress on the bottom, or 800-ft level. The company is a subsidiary of Malartic Gold Fields which is financing and managing the operation and has agreed to mill the ore developed.

Sigma Mines is well into the major internal shaft sinking program at its gold property in the Val d'Or district. The program, which will open a block of six new levels from the 24th down to the 30th horizon, is expected to cost over $1-million and is scheduled to be completed during the first quarter of 1961.

Agreements between Falconbridge Nickel Mines, Canadian Malartic Gold Mines and Marchant Mining Co. have been signed. A new operating company

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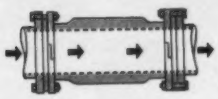

- Unobstructed flow eliminates high friction loss.
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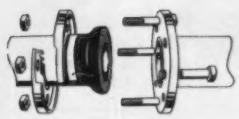

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is being formed to take over the property in LaMotte Township and will be jointly owned by Falconbridge and Marchant. Falconbridge will carry out development and operations at the high grade nickel property. Work is currently in progress in preparation for shaft sinking. Canadian Malartic has agreed to treat up to 2,800 tons per week, or 400 tpd. Ore will be trucked some 20 miles to the mill at Malartic.

Production at Barnat Mines' gold producing property in the Bourlamaque area is being progressively increased. By mid-1961 it is expected to be at 1,850 tpd with most of the increased tonnage being treated in the nearby mill of Malartic Gold Fields. Shipments of Barnat to the Malartic mill started last November. Present schedule calls for shipments at the rate of 15,000 tons per month with increase to 25,000 tons by Sept. 1 and ultimately to 36,500 tons per month by mid-1961. Ore reserves have been more than doubled during the past year and stand at 692,264 tons grading 0.153 oz gold per ton. This includes only a small portion of the estimated 5,000,000 tons indicated in the new No. 4 porphyry orebody.

Iron ore production from Hollinger North Shore Exploration totaled 9,469,065 tons in 1959. Ore shipped from the port of Sept Isles totaled 9,701,123 tons, of which 1,814,489 tons was for Hollinger North Shore account with the remainder being for Iron Ore Company of Canada, the operating company, with Hollinger North Shore drawing royalty on this tonnage. Hollinger North Shore is owned 60% by Hollinger Consolidated Gold Mines and 40% by the Hanna Mining Co. of Cleveland.

Sullivan Consolidated Mines has boosted mill rate from 500 to 725 tpd at its gold operation in the Val d'Or area. New mill capacity is 750 tons. New sources of ore continue to be found. The lastest, discovered on one of the original upper levels, has indicated sizable tonnage. Work is also in progress on the new deep levels.

BRITISH COLUMBIA

The Sumitomo mining group of Japan has agreed on plans to finance production at the Highland Valley property of Bethlehem Copper Corp. Ltd. at a cost of $7.5-million to $9-million.

The group has already invested $350,000 in development work and has until February 1961 to make final decision regarding production. It has also put down $100,000 as an option on a 5,600-ton mill with the Manitou-Barvue Mines Ltd. Mill's total cost is $1.5-million and it will be moved to B.C. from Quebec.

Sumitomo will have the right to all production for 10 years and all advances are to be repaid to Sumitomo over this period.

According to the annual report the Bethlehem exploration program has shown "reasonable assured tonnage" of 18,100,000 tons of .83% copper in the Jersey and East Jersey orebodies. Drilling has indicated a further 41.4-million tons below the tunnel level. Potential zones available for future exploration include the Iona, Simons, Snowstorm, White "A" and "B."

Target date for putting the property in production is September 1962.

Development of the Mona group of West-Coast Resources Ltd. has been undertaken by a group of companies consisting of Tombac Explorations, Magnum Copper and Centennial Mines. The same group has optioned a further six anomalies and will start exploration immediately.

Sheep Creek Mines Ltd. plans to open up Paradise Mine located in the same area as the company's Mineral King property. It is planned to ship about 40 tpd of silver-lead-zinc ore. Milling will be done at the Mineral King Mine.

Skookum Uranium Inc., Spokane, plans to start production this summer at a gold placer property near Nelway, according to Theodore A. Tester, Opportunity, Wash., president of the firm. The company moved mining equipment into the area in June.

Officials said a wood flume has been built to divert Fifteen Mile creek around the placer site. The water will be used to wash gold-bearing gravel through sluice boxes. E. J. Timmons, Spokane, is in charge of the project.

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ALBERTA

Alberta's oil sands have attracted two new separate applications for approval. Alberta Oil & Gas Conservation Board served notice that board hearings into both applications have been scheduled for Aug. 17. Application has been made by Pan American Petroleum Corp. for approval of a scheme for recovery of oil or a crude hydrocarbon product from oil sands in the Athabasca area. The other application has been made by Cities Service Athabasca Inc., representing itself and Imperial Oil Ltd., Richfield Oil Corp. and Royalite Oil Co. Ltd., to recover oil or crude hydrocarbon product in the Mildred Ruth Lakes area.

Since the Alberta government will permit only one plant to be built in the foreseeable future, the application of Great Canadian Oil Sands Ltd. has been criticized by the Cities Service combine at a Conservation Board hearing in Calgary. Pan Am's application is for in situ combustion experiments in the McMurray oil sands.

Criticism of Great Canadian's application by officials of the Cities Service group centered on the tailings disposal system. These officials believe that there is a danger the tailings will slide and create a hazard because of particle uniformity, roundness and lubrication by unextracted oil. They also stated that their own pilot tests of a bucket wheel mining system at Athabasca (E&MJ, March 1960, p 108) had proved unsuccessful because of (1) a large quantity of hard limestone boulders and a large percentage of hard layers of shale and siltstone, (2) a greater shearing resistance of the tar sand (requiring more power), and (3) soft pockets in the tar sand during hot weather. The group has invested more than $9.5-million in developing a commercially practical process for developing the tar sands and currently is spending at the rate of $3-million yearly on further research and development work. The Cities Service group maintains that research by Great Canadian is inadequate.

Counsel for Great Canadian insisted that there were no chunks of limestone or boulders encountered on Great Canadian's lease such as those referred to by the Cities Service group. Dr. K. A. Clark, former head of Oil Sands Section, Research Council of Alberta, testified to the effect that the group's lease was in a disturbed area where a slide had occurred in past times and thus conditions encountered by the team do not mean that the same conditions would apply elsewhere. Dr. Hardy also stated the particles were angular or sub-angular and not rounded. As for the tailings disposal problem, Great Canadian plans to mix overburden with the tailings and to leave a retaining wall of unmined material.

Meanwhile, the Alberta Conservation Board indicated that recovery and storage of sulphur would enhance chances of favorable action on application for commercial development of oil sands. Board spokesmen also indicated that the size of the proposed operation would be an important factor.

As to nuclear blast proposals (E&MJ, June 1960, p 306), Great Canadian's managing director, Thomas P. Clarke, stated that he doubted whether permission could be received from any government to use it and "therefore we can dispense with it."

IN LATIN AMERICA

BRAZIL

A bill to expropriate manganese deposits in dispute between two Brazilian groups and to set up a "mixed company"—part government, part private—to develop them has been introduced into the Minas Gerais state legislature.

The properties are in the towns of Sao Domingos do Prata and Dom Silverio in the mineral-rich state of Minas Gerais. Government permission to mine deposits is held by the Empresa Continental de Minerios, controlled by the Jaffet metallurgy interests, but legal action by another group, which has taken the case to the Supreme Court, has held up development.

Under the bill introduced by State Deputy Mario Rolla, a mixed company called Companhia Ferro Manganes de

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ALBERTA

Alberta's oil sands have attracted two new separate applications for approval. Alberta Oil & Gas Conservation Board served notice that board hearings into both applications have been scheduled for Aug. 17. Application has been made by Pan American Petroleum Corp. for approval of a scheme for recovery of oil or a crude hydrocarbon product from oil sands in the Athabasca area. The other application has been made by Cities Service Athabasca Inc., representing itself and Imperial Oil Ltd., Richfield Oil Corp. and Royalite Oil Co. Ltd., to recover oil or crude hydrocarbon product in the Mildred Ruth Lakes area.

Since the Alberta government will permit only one plant to be built in the foreseeable future, the application of Great Canadian Oil Sands Ltd. has been criticized by the Cities Service combine at a Conservation Board hearing in Calgary. Pan Am's application is for in situ combustion experiments in the McMurray oil sands.

Criticism of Great Canadian's application by officials of the Cities Service group centered on the tailings disposal system. These officials believe that there is a danger the tailings will slide and create a hazard because of particle uniformity, roundness and lubrication by unextracted oil. They also stated that their own pilot tests of a bucket wheel mining system at Athabasca (E&MJ, March 1960, p 108) had proved unsuccessful because of (1) a large quantity of hard limestone boulders and a large percentage of hard layers of shale and siltstone, (2) a greater shearing resistance of the tar sand (requiring more power), and (3) soft pockets in the tar sand during hot weather. The group has invested more than $9.5-million in developing a commercially practical process for developing the tar sands and currently is spending at the rate of $3-million yearly on further research and development work. The Cities Service group maintains that research by Great Canadian is inadequate.

Counsel for Great Canadian insisted that there were no chunks of limestone or boulders encountered on Great Canadian's lease such as those referred to by the Cities Service group. Dr. K. A. Clark, former head of Oil Sands Section, Research Council of Alberta, testified to the effect that the group's lease was in a disturbed area where a slide had occurred in past times and thus conditions encountered by the team do not mean that the same conditions would apply elsewhere. Dr. Hardy also stated the particles were angular or sub-angular and not rounded. As for the tailings disposal problem, Great Canadian plans to mix overburden with the tailings and to leave a retaining wall of unmined material.

Meanwhile, the Alberta Conservation Board indicated that recovery and storage of sulphur would enhance chances of favorable action on application for commercial development of oil sands. Board spokesmen also indicated that the size of the proposed operation would be an important factor.

As to nuclear blast proposals (E&MJ, June 1960, p 306), Great Canadian's managing director, Thomas P. Clarke, stated that he doubted whether permission could be received from any government to use it and "therefore we can dispense with it."

IN LATIN AMERICA

BRAZIL

A bill to expropriate manganese deposits in dispute between two Brazilian groups and to set up a "mixed company"—part government, part private—to develop them has been introduced into the Minas Gerais state legislature.

The properties are in the towns of Sao Domingos do Prata and Dom Silverio in the mineral-rich state of Minas Gerais. Government permission to mine deposits is held by the Empresa Continental de Minerios, controlled by the Jaffet metallurgy interests, but legal action by another group, which has taken the case to the Supreme Court, has held up development.

Under the bill introduced by State Deputy Mario Rolla, a mixed company called Companhia Ferro Manganes de

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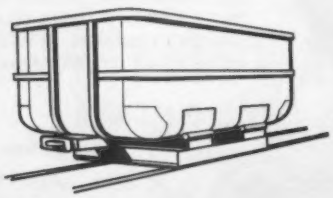
Kermac Nuclear Fuels Corporation is operating four major wet mines in the Ambrosio Lake area of New Mexico. Slop-forming shale lenses interbedded in the ore help form a watery muck that flows easily when handled but sticks tightly to machinery, pockets and car bodies when allowed to settle. To solve this tough problem, Card furnished a string of 40 special "Telluride Type" cars that feature a solid body for side dumping and intense shaking. The cars range from 77 cu. ft. to 110 cu. ft. capacity.

Following successful introduction of the first lot of those heavy duty Card cars, Kermac Nuclear has placed additional orders which will provide them a complement of 82 cars of this type. No haulage troubles have been encountered with these cars, and resulting haulage costs are satisfyingly low.

Solve your haulage with an economical Card design. Our engineers can supply an efficient car to meet your most difficult specifications.



C.S. Card Iron Works Co.
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DENVER, COLORADO

Brazil *(Continued)*

Minas Gerais; with an initial capitalization of 500-million cruzeiros (approximately $2.7-million at the free rate of exchange) would be established to work the mines and manufacture 100,000 tons of manganese-steel alloys annually. Manganese reserves in Minas Gerais are estimated at 8-million tons.

Companhia Brasileira de Chumbo (Cobrac), with an initial capitalization of 5-million cruzeiros (approximately $27,000), has been formed as a subsidiary of the Companhia de Acumuladores Presto-Lite for mining and refining lead at Boquira, in the state of Bahia.

Presto-Lite, makers of accumulators and batteries in Brazil, acquired control of Mineracao Boquira Ltd. in 1957 for a reported $500,000. Brazil's lead refining capacity is expected to reach 20,000 tpy by next year, with Presto-Lite accounting for nearly three-fourths.

CHILE

On May 15 Chuquicamata completed 45 years of production under modern mining and metallurgical methods. Chuquicamata, like El Salvador, had been worked by the native Indians for the most striking oxidized copper minerals they contain to make semi-precious stones for their womenfolk. During this 45-year period, Chuqui has produced 6,835,000 tons of copper and the owners have invested $366-million in the property, paid $474-million in taxes to the State and returned to the country $610-million to pay for the cost of production within Chile.

The Central Bank, which now handles all matters concerned with import and export licenses, has approved the importation of a number of large trucks and mining machinery for the Santa Fé iron ore mining company amounting to $190,000.

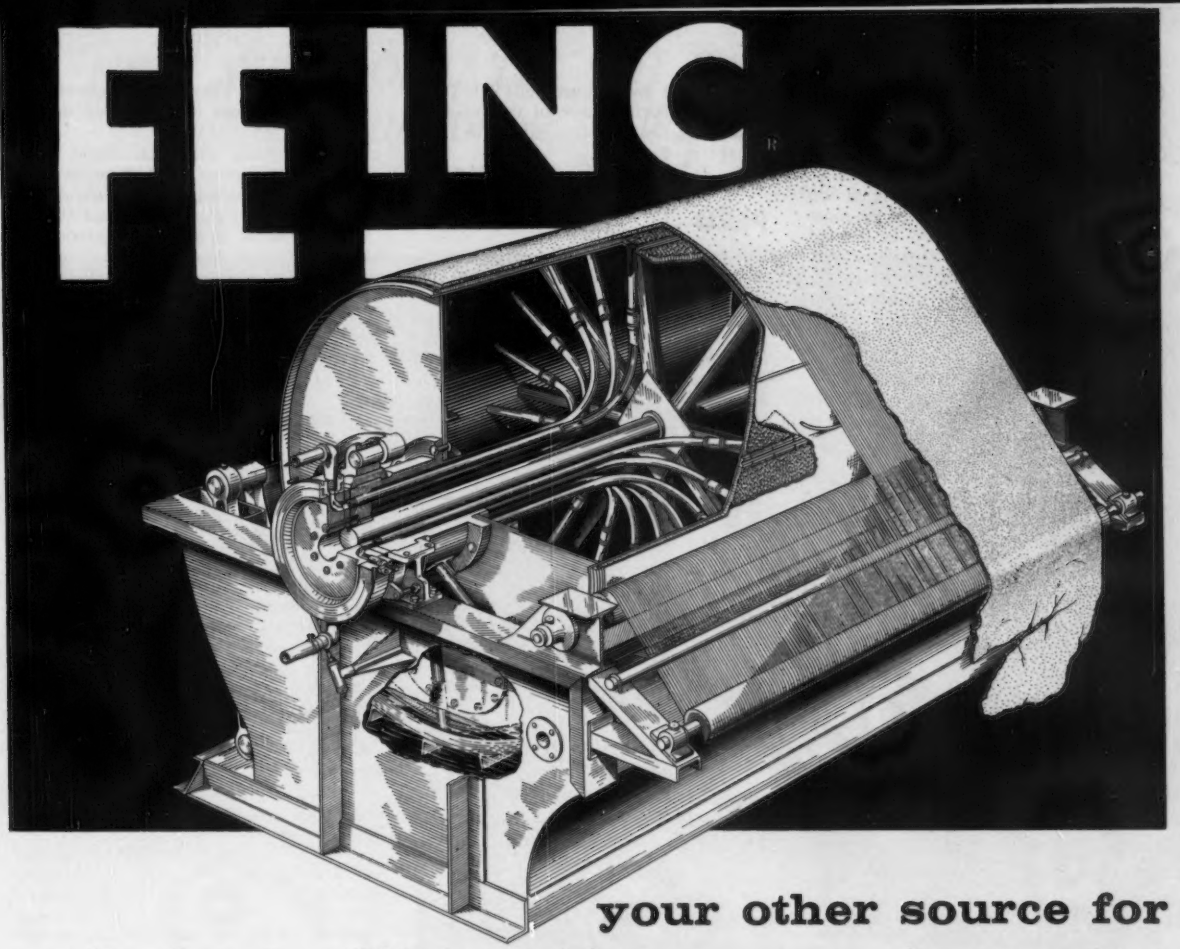
Several Japanese engineers from the Furukawa Mining Co. have been visiting mining camps in Chile, especially copper mines, mills and smelters.

After a strike which lasted for 36 working days, the men working at the mine and mill of Compañía Minera Delirio de Punitaqui went back to work.

An agreement between the UN and the Chilean government was signed at the Ministry for Foreign Affairs to make a geological survey of northern Chile. The UN will contribute $990,300 and will be responsible for the development of the program while the Chilean government will contribute $740,000.

This program has two objectives in view: To try to diversify the Chilean economy which is chiefly dependent on copper at the present time; and, to revitalize the Tarapacá province which has been severely affected by the shutting down of numerous small nitrate mines and plants working the old Shanks process. The program includes the geological mapping of the most important mining districts and especially of those within

FE INC



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Chile *(Continued)*

the Atacama desert which are rich in copper, iron, lead, manganese, gold, silver, sulphur, nitrate, borax and other salts. Besides geological mapping in the classical way, detailed studies of the most important mining camps will be carried out including airborne surveys, geochemical studies and drilling where advisable.

The UN will supply the required mining geologists and other experts in geophysical work. The Chilean contribution will be mostly carried out by the Institute for Geological Investigations which will also provide several geologists, drillers, surveyors, draftsmen and general helpers. The Swedish geologist Elis Dahlstrom will be in charge of the program. Dahlstrom has already arrived in Chile to take up his work.

PERU

A proposal for the financing and construction of a zinc smelter and refinery in the mining region of the Central Andes was presented to a meeting of the Directors of the National Society of Mining & Petroleum on June 9 by Archduke Felix of Austria, Prince Barb, on behalf of "Sybetra" (Syndicat Belge d'Enterprises a l'Etranger), a consortium representing more than 60% of Belgian industry.

The proposed zinc plant would represent an investment of $10-million and would be completed in two years. A similar plant, using coal gas instead of electrolytic process, is now being constructed by "Sybetra" in Mexico, with a capacity of 30,000 tpy of refined zinc. Belgium is said to be the world's largest exporter of refined zinc and has long been a leader in the metallurgy of this metal.

The National Mining Society has agreed to call a meeting of Peruvian zinc producers and directors of the Mining Bank and of the Institute of Mining Engineers to consider the "Sybetra" proposal.

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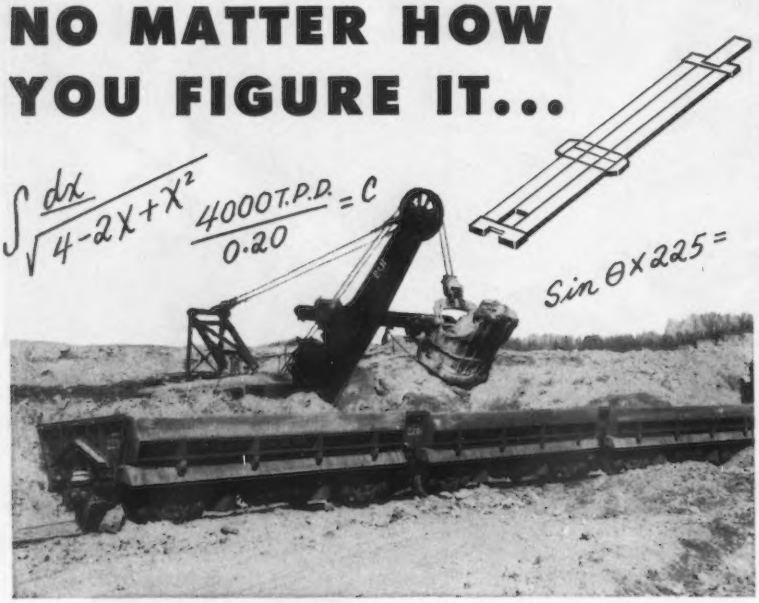

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EL SALVADOR

The chief of an autonomous governmental agency that lent $440,000 in the past several years in an effort to keep open the Montecristo gold and silver mine in eastern El Salvador said that plans are well advanced for reopening the mine, as well as others closed previously because production failed to offer reimbursement for operating costs.

Wilfredo Navarrete, manager of the Salvadoran Institute to Foment Production (Insafop), said Montecristo, the last gold mine to operate in El Salvador, would be placed under the supervision of a competent firm, with a long-term contract. He confirmed recent reports that the Coronado Corp., an American firm which he said has operated in different countries, is interested in the proposition, and has been inspecting the Montecristo property to see whether it can be exploited profitably.

Navarrete intimated that more than 1,000 workers might be employed if Montecristo and other nearby mines are reopened.

IN AFRICA

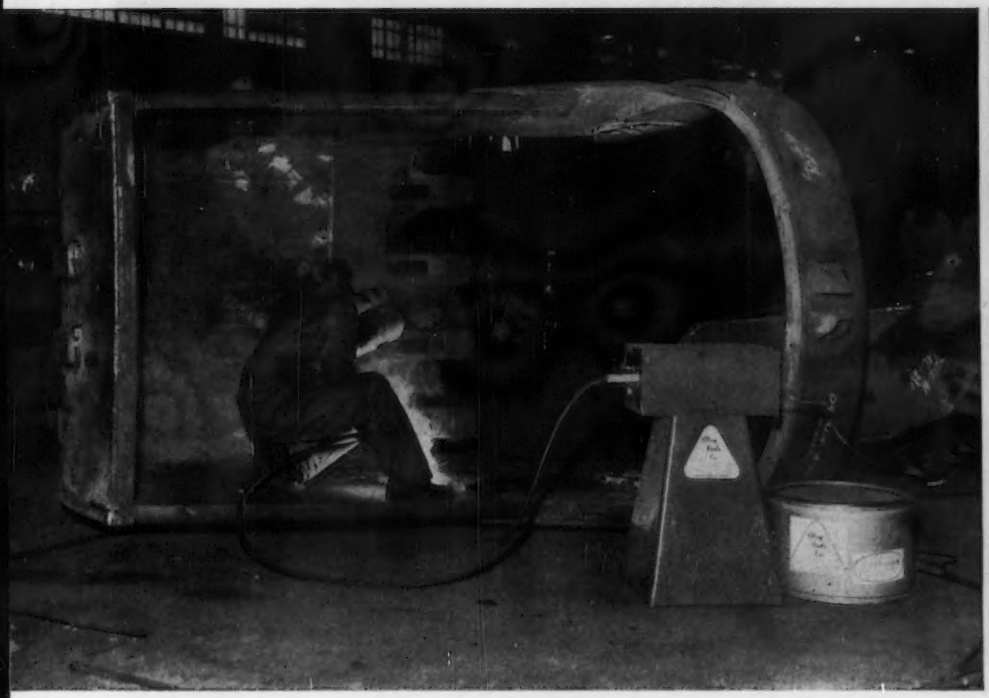
A full-scale model of man—in effect a mass of instruments built into the model of a human being—is being used by the Transvaal and Orange Free State Chamber of Mines to get a direct measurement of convective and radiation heat exchanges.

This is but one of a wide range of important research projects undertaken by the chamber. Research into the problems of heat, dust and ventilation figure prominently in its activities, reported on at the annual general meeting on June 27.

Research men employed by the chamber have also designed what they describe as a "human calorimeter"—a small aluminum-enclosed chamber where the different forms of heat experienced by a mineworker on shift can be measured in the body of a miner seated inside the unit.

Workers have made on-the-spot tests at different gold-mines in an attempt to determine the likely body temperature

NEW WEAR-O-MATIC WH Produces High Strength Manganese Attachment Welds Equal to 308 Stainless For PAGE ENGINEERING COMPANY



The Page Engineering Co. was founded in 1903 by Mr. John W. Page who originated the dragline method of digging. Today Page Engineering is the nation's leading manufacturer of dragline buckets, walking draglines and other equipment used in dragline operations.

High strength properties and crack free deposits are the two major requirements for welding alloys used to attach manganese parts to PAGE AUTOMATIC BUCKETS made of high strength alloy steel. Until recently, only type 308 stainless manual electrodes satisfactorily met both requirements. Other alloys have been tested from time to time but failed one or both tests leaving Page no choice but to continue using 308 stainless electrodes for critical joints.

Now, new Wear-O-Matic WH semi-automatic wire developed by Alloy Rods Company fills both the requirements by producing high strength properties identical to those of 308 stainless electrodes while depositing absolutely crack-free weld metal. The Page Engineering Co. has replaced most 308 stainless welding in their dragline bucket production with new Wear-O-Matic WH alloy, gaining the economies of semi-automatic open arc welding and retaining the same high strength requirements for manganese attachment welding. Page engineers report Wear-O-Matic WH gives them the additional advantages of faster deposition and smoother arc characteristics—better than any semi-automatic wire they have ever used in the production fabrication of dragline buckets.

You too, can benefit from the experiences of Page Engineering. For any application involving the high strength attachment welding of manganese, whether it be production fabrication of manganese parts or field maintenance, Wear-O-Matic WH will do the job better than any alloy you are now using and do it semi-automatically. Contact your Alloy Rods Company distributor or Hard Surfacing Specialist for specific application information. Or write direct to Alloy Rods Company, P. O. Box 1828, York 49, Pennsylvania.

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Shown is a typical Jeffrey chain application. Custom-built to meet conditions in an individual mine, all "Canton" track cleaners have this in common: *Jeffrey chain is standard equipment.* The chain drives the gathering conveyor that carries material rearward from the digger plate and side plows. It drives the boom conveyor that discharges into a tow car.

Canton track cleaners clear mine roads at a fraction of the cost for hand loading, prevent derailments and consequent work stoppages. They save money for mine operators with fast clean up.

Jeffrey chain was selected as a part of the "beefing up" in design to withstand extreme wear and stress. It may be the answer to your drive and conveyor problems. For fast service on your chain requirements, call your nearest Jeffrey distributor. For a copy of Catalog 999 describing Jeffrey chain, write The Jeffrey Manufacturing Company, 974 North Fourth Street, Columbus 16, Ohio.

Track cleaners by American Mine Door Company of Canton, Ohio, using Jeffrey chain, are working in all types of mines.

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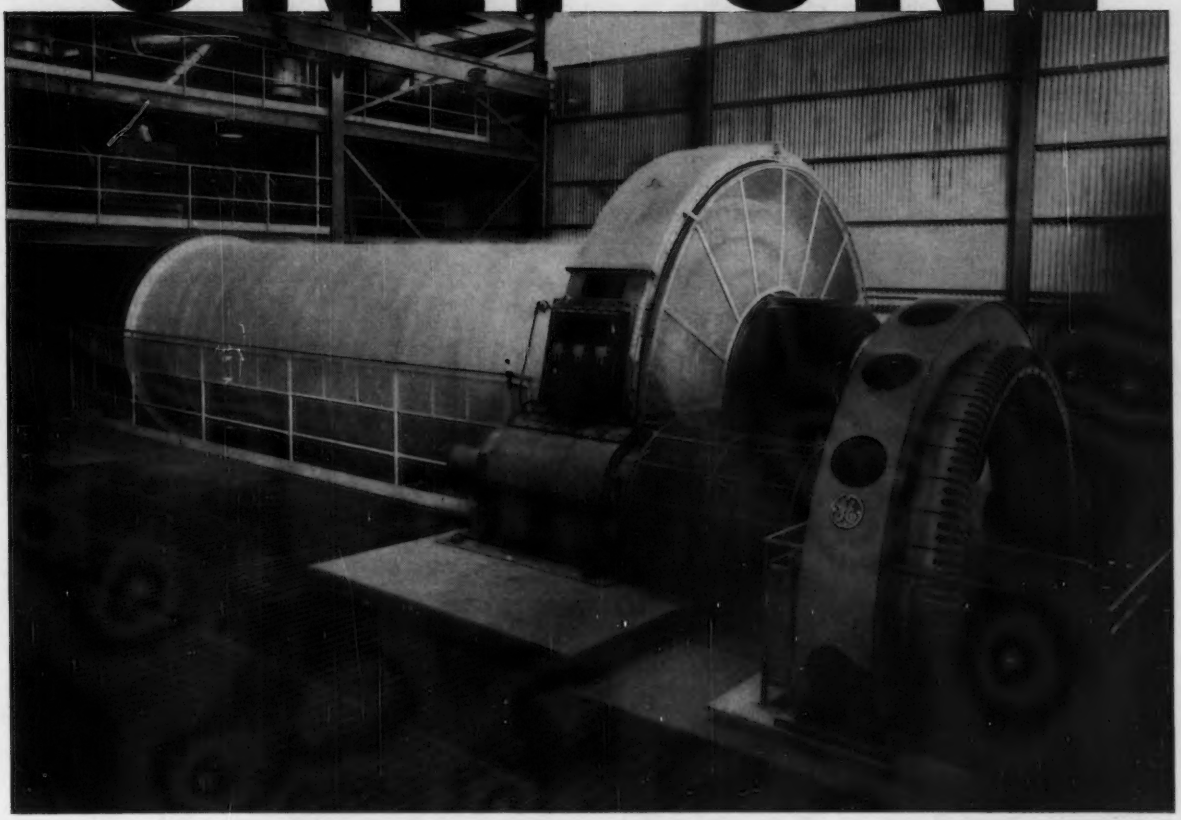

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Africa *(Continued)*

under which heat-stroke will occur and the influence of altitude on lung ventilation, pulse rate and oxygen intake. They have also studied the effect of different methods of underground acclimatization. A pilot study was carried out on an East Rand mine to measure the influence of different qualities of supervision on car-lashing performance at wet-bulb temperatures in the range of 81° F to 96° F.

The preservative treatment of timber has come in for fairly detailed attention. Several points have been examined in this connection: (a) the minimum concentration of different preservative mixtures required to prevent the growth of destructive fungi and of *sporotrichun beurmanni;* (b) the rate of leaching of the preservatives used in the industry, and (c) the development of tolerance to chemicals by certain fungi occurring in the mines.

Experiments have commenced in a study of bacterial leaching of uranium from low-grade ores. Bacteria believed materially to enhance leaching have been collected and pure cultures of two types produced in the laboratory.

Work has also been started on an examination of the methods of purification of uranium plant effluents and the recovery of valuable materials from them. Effluents from 17 mines have been examined for the presence of some 20 elements. Methods have been developed in the laboratory for the rapid qualitative analysis of uranium plant effluents and quantitative methods are currently being developed.

The dust ventilation laboratories have their own underground research team which is looking for ways of keeping down dust in underground workings. Dust blown from mine dumps on windy days has been sampled and analysed.

Systematic prospecting is being carried out in South Africa to uncover deposits of thorium. This fissionable material is known to occur in the Vanrynsdorp area of the Cape Province.

The Consolidated Murchison Mine in the Letaba area of the North-Eastern Transvaal has intensified exploration to meet increased demand for antimony cobbed ore and concentrates. The mine has acquired over 1,000 base metal claims.

The Swaziland Iron Ore Development Co., administered by Anglo American, has completed a geological and metallurgical survey of the iron ore deposit at Bomvu Ridge, near Mbabane, capital of Swaziland. The company is now investigating the physical condition of the ore. The company has an exclusive prospecting licence covering an area of 2½ square miles.

An extensive co-ordinated search for minerals is being made in Northern Rhodesia by Chartered Exploration Limited which is financed by Anglo American, the British South Africa Company and New Consolidated Gold Fields. Work is going on in the Western Province, the Zambezi Valley along the Southern Rhodesia border and in other areas.

A mobile milling unit has been demonstrated in the Midlands of Southern Rhodesia which might enable smallworkers to introduce a new technique in gold mining practice. It is reported that the mill can be in operation within an hour of arriving at a site and that working costs would be about 8s. 6d. ($1.20) a ton (with a large South African gold mine, working costs vary from about 25s. [$3.50] to 80s. [$11.20]).

The Simmer and Jack Mine, which commenced production in 1888, has now virtually reached the reclamation state. Work is concentrated on recovering all available ore from this mine which is situated in the Germiston area of the East Witwatersrand and forms part of the Consolidated Gold Fields group. Movements of ground and increasing shortage of stope face are making it increasingly difficult to mine the property on a profitable basis.

Intense shaft-sinking activity in the goldfields of the Transvaal and the Orange Free State is irrefutable evidence of the unflagging vigor of the Union's gold-mining industry. Now fewer than 37

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The Service Elevator for Preparation Plants and Underground Installations

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This all-steel Connellsville MINICAGE with 1000 lbs. and up capacity travels the outside wall of an existing preparation plant . . . or may be designed for inside a future-planned facility. Operates automatically at speeds of 50 to 75 feet a minute.

The sturdy fabricated steel structure with pantograph-style gate is mounted in place and safely attached to wall. Drive assembly at top of structure is coordinated with the MINICAGE and level doors by a control system. Wall openings at levels have hinged safety doors.

The entire Connellsville MINICAGE installation complies with federal and state mining laws.

For additional information and details on the Connellsville MINICAGE and other elevators, cages, hoists and conversion units, write for Bulletin No. 200.

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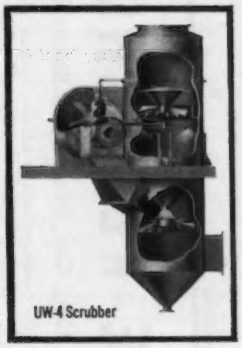

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There's an old song that goes something like this: "It Ain't What You Do; It's The Way That You Do It." This holds true for wet dust collection and one of the most effective ways of doing it is dynamically with a Ducon UW-4 Scrubber.

The centrifugal forces and water action inside this scrubber, combining with the unique and effective dynamic action of the high velocity fan in the second stage of operation, literally swirl, swat and scrub all the dust particles from the gas stream.

The UW-4 Scrubber is a most effective unit for separation of extremely fine dusts and abrasive materials and is ideally suited for heavy dust loads and high temperature applications.

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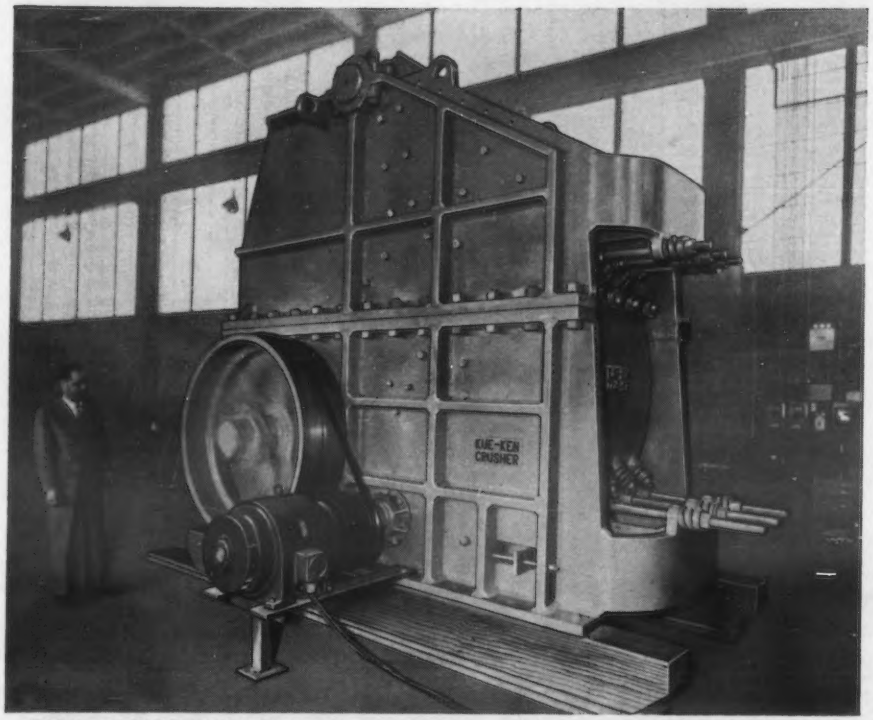
KUE-KEN® greater leverage permits small motor



#160 — 48″x42″ KUE-KEN Jaw Crusher mounted on skids *not fastened to floor* and running at 275 RPM, the operating speed. A 30 HP normal duty squirrel cage motor starts this crusher with a single vee belt. Only 17 HP is required to run crusher at full speed. High efficiency and smooth running of KUE-KEN Crushers is clearly shown by above performance. 33 sizes of KUE-KEN Crusher available from 12″x7″ to 48″x48″.

KUE-KEN designs maximum leverage where it counts most . . . at the top of the swing jaw for crushing large rocks.

The swing jaw is supported on the stationary hinge pin in center line of the crushing zone. This pendulum type jaw swings in an almost straight line to crush rock squarely without rubbing. Jaw plates last at least 5 times longer and far less power is used.

No power is wasted in lifting heavy swing jaws as in all other crushers and power is not wasted in wearing out jaw plates.

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PATENTED TRAMP IRON RELEASE! Simple, adjustable safety release integral with flywheel. No shearing or breaking parts. Positive protection against tramp iron. Production resumed in minutes.

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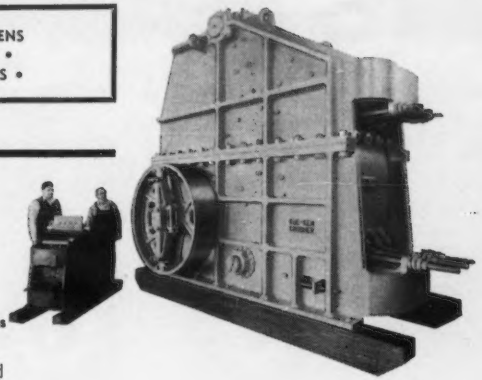
HEAVY DUTY APRON FEEDERS •
KUE-KEN GYRATORY CRUSHERS •



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shafts are being sunk at present or are contemplated in respect of 21 mines. The total capital outlay involved in the current shaft-sinking program is more than £65 million ($182 million). And these figures do not account for shaft-sinking activity at depth in some mines, which might also be regarded as development activity.

Details of work planned or in progress show that on a straight lift, two shafts at Zandpan, an Anglo-Vaal mine in the Klerksdorp area of the Western Transvaal will go deepest (7,500 ft). This depth will be beaten by a substantial footage at Western Deep Levels—the Anglo American mine in the Carletonville district of the Far West Witwatersrand. Two shafts being sunk at that mine will go down about 8,500 ft, but in two stages.

The cost of sinking and equipping the shafts varies widely according to depth, diameter, the purpose of the shaft and the nature of the rock being pierced. But some idea of the enormous cost of modern mining techniques may be gained from estimated outlay in the sinking of the Scott shaft at the General Mining Company's Stilfontein mine. It will be sunk to 6,500 ft, with a diameter of 26 ft. It will cost nearly £5 million ($14) million to sink and equip.

The record-breaking climb in South African gold production continued in June which recorded an output for Transvaal and Orange Free State mines of 1,812,865 oz compared with 1,803,777 oz in May. The June value was £22,653,259 ($63,429,125), also an all-time record for South African gold production in any one month.

Output is now running at an annual rate of £272-million ($761.6-million)—a substantial increase on the 1959 figure which was just over £250-million ($700-million).

Aluminium Ltd has announced that Ghana Aluminium Products Ltd, its associated company in Ghana, will expand its operations at Tema by the installation of an aluminum rolling mill next to its existing factory. The new project will cost approximately $2,750,000. The new rolling mill will be able to serve the entire market requirements of Ghana for aluminum sheet products. Production should begin early in 1962.

When the rolling mill is in full operation, shares in the company will be available for investment by the Ghanaian public. Ghana Aluminum Products began production of corrugated aluminum roofing sheet at Tema in August 1959. The construction of a second factory to produce a wide range of aluminum products is already well advanced. The new rolling mill will be the third stage in the company's expansion program.

A £5,000 ($14,000) drilling program is being carried out at Kangankunde Hill in the Zomba District of Nyasaland by the Department of Geological Survey and private contractors in collaboration. Minerals detected in the area include monazite.

Southern Rhodesia last year received 14 applications for exclusive prospecting orders from exploration companies, covering a total of 1,500 square miles. Copper, nickel and iron ore deposits attracted most attention.

Interest was shown by large exploration companies from many parts of the world, including South Africa and Japan.

During 1959 the Rhodesia Broken Hill Development Co. Ltd. in Northern Rhodesia produced 29,895 long tons of zinc; 14,400 long tons of lead and nearly 257,000 troy oz of silver.

A world tunneling record for a standard 11 x 13 ft haulage tunnel has been set in South Africa. The record was established at Loraine Gold Mines Ltd. at Allenridge, Orange Free State, South Africa. The crews drove 2,695 ft in 26 working days. The new mark is almost 300 ft better than the previous record for this type tunnel.

Loraine set the record while driving two parallel tunnels about 30 ft apart. The tunnels are connected every 500 ft by crosscuts. The best footage obtained in one day was 120 ft. Twenty rounds, averaging 6 ft per round, were drilled, blasted and loaded during the 24 hours. The record is even more remarkable because the tunnel headings were 17,500 and 20,000 ft away from main haulage shafts. Loading was by an Eimco 40H.

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PHILIPPINES

Atlas Consolidated milled 260,400 tons in May averaging 0.65% Cu. Total production during the month was nearly 3 million lb. This showed an improvement over April because of a better grade of ore. In the big Lutupan pit, some encouraging new ore has been encountered near the rim that had not been included in the original estimate of the reserves. Stripping is progressing at an accelerated rate but has not interfered with input to the mill. The management plans to step up copper production to 3,250,000 lb a month. The new underground conveyor is reducing costs of moving ore. From the Mati iron mine in Davao, Atlas shipped 7680 tons of iron concentrates to Japan. The total value of all shipments during May exceeded $1,175,000 in value. Continuation of barter agreements with Japan have added measurably to profits.

Benguet Consolidated, the Philippines leading gold producer, is operating at normal rate. In May about 3600 tpd were put through the central mill with production of 21,064 oz of gold from 0.2 oz heads. It is announced that the company is considering the sale ultimately of some of its holdings in subsidiaries to Filipino interests in line with the "Filipino First" policy and will carry out its diversification program in acquiring new businesses with this policy in mind. The company reports that Benguet's profit in 1959 was a record $2,800,000 against the previous year's net of $1,715,000.

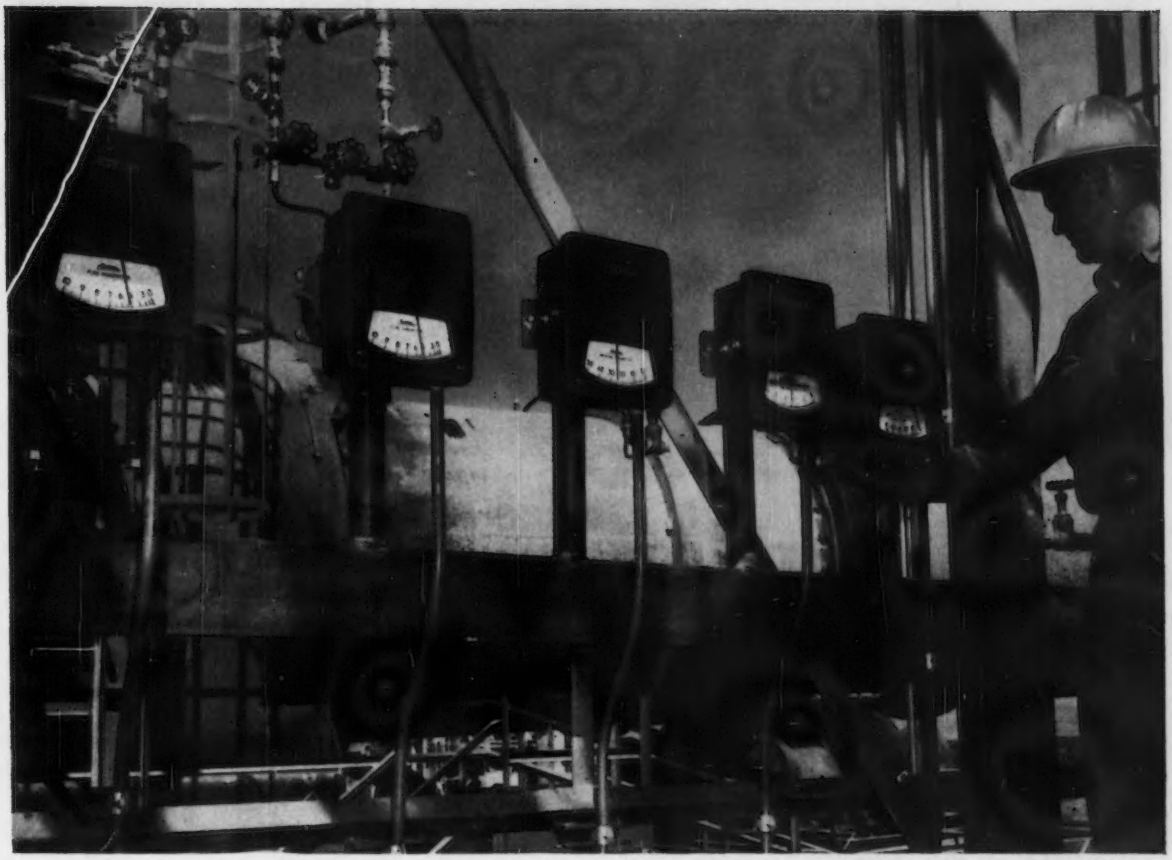
Marinduque Iron Works made direct shipment of 6250 tons of 6.1% copper ore to Japan from its Bagacay mine, as well as 1400 tons of concentrates. From the company's Sipalay mine in Occidental Negros, 1079 tons of concentrates, estimated to contain 531,000 lb of copper were produced.

Lepanto Consolidated, second largest copper producer in the Philippines, shipped 7400 metric tons of concentrates to Tacoma in May, estimated to contain 5,193,000 lb of copper and 6718 oz of gold. This was the company's 92nd postwar shipment of concentrates. In May the company milled 38,660 tons with average copper content of 3.85% and 0.156 oz of gold per ton. About 1300 tpd were milled. Copper recovery was 96% and gold 78%. The ore is principally enargite.

Philex Mining Corp. milled 56,600 tons of disseminated copper ore in May at its Santo Tomas plant in Baguio. The metal content was estimated at 738,000 lb of copper and 1150 oz of gold with a gross value of over $300,000.

Consolidated Mines shipped a record total of 87,000 tons of refractory grade chromite ore in May, valued at over $1,180,000. About 55% was exported to U.S. and Canada, 37% to Europe and the U.K., and the balance to Japan.

In 1959 the Philippines had 16 metal producing mines. There were four



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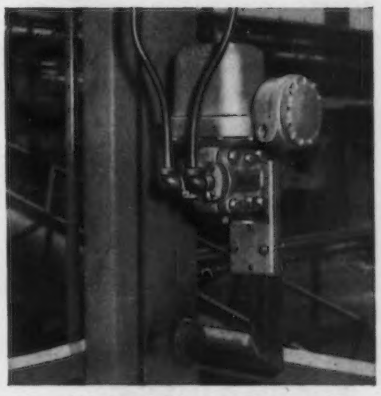

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Philippines *(Continued)*

straight gold mines, two iron mines, two chromite mines, one manganese and one quicksilver. Other large companies, notably Atlas Consolidated, Lepanto, and Samar, produced both copper and gold, and Surigao Consolidated had gold, lead and zinc. The Central Bank's annual report on the Philippine economy noted that mining production ran 8% above 1958, about the same rate of increase as the manufacturing production index.

Surigao Consolidated has added zinc concentrates to its production of gold and lead from its Surigao mine. The company shipped 1206 tons of concentrates in May obtained as a by-product which was estimated to contain 1,226,000 lb of zinc with small amounts of silver and gold. The shipment was made to American buyers.

EUROPE

Nationalized in 1946 as part of the "basic industries", the Austrian nonferrous metals industry has grown into a major factor in Austrian raw material supply; vertical structure of the mining and processing industry has, together with tight government price control, kept raw material cost to steady levels, thus cutting out most of the ups and downs of world market price fluctuations. Mineral production was up, generally, in 1959 over 1958.

Austrian Mineral Output

(In Metric Tons)

Ore	1958	1959
Copper	164,489	162,600
Lead-Zinc	187,912	193,957
Antimony	11,198	12,978
Bauxite	23,570	23,981
Metal		
Aluminum	74,000	85,160
Copper	9,500	10,524
Zinc	10,500	11,498
Lead	8,910	8,073

Greece's first Aluminum complex, composed of an alumina plant with 100,000 metric ton initial capacity and an aluminum plant capable of producing over 50,000 tons annually, is being blueprinted by a Franco-Greek group made up of French aluminum producers, Pechiney and Ugine, and the Greek shipping magnate, Niarchos. The group is now negotiating with Reynolds Metals Co., who may eventually join the venture.

Cost of the two plants, which will use bauxite from Greek deposits and electricity from three power plants to be built on the Acheloos River, is estimated at $75 million. Hydroelectric installations will reportedly cost another $125 million.

A bill pending before the Sicilian Regional Assembly calls for the establishment of a regional sulphur company with power to take over and reorganize existing enterprises and modernize them. The capital of the company can also be sold to private individuals and companies at a rate not exceeding 40%, with the controlling 60% to remain in the hands of public agencies, the Enti Zolfi Italiani (The National Sulphur Agency) and the SOFIS, a local agency for the financing of industrial enterprises in Sicily.

The Minnesota Mining and Manufacturing Co. has purchased 2,690,975 sq ft of land near Caserta, in Southern Italy, to build a huge industrial complex over the next 12 years.

The announcement was made by Mr. Maynard H. Patterson, vice president of the 3M and general manager of the company's International Division. Mr. Patterson added that personnel would be entirely Italian. The complex will produce many of the 3M's wide range of products.

A drag excavator costing $375,000 for the open-cast sulphur mine which recently began operating near Nowa Huta, Poland, was bought by the Polish state agency CEKOP from Fried. Krupp, Essen, West-Germany, company spokesman reported. Complete equipment for the production of mine conveyor belts

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Italy *(Continued)*

purchased recently in Great Britain cost $475,000, it was added.

JAPAN

The Kawasaki Steel Co. received this week a report of commitments of the World Bank and U.S. moneyed interests from its representative, now visiting the U.S. for a total of $12-million loan to help finance construction of a $21-million mill in Chiba, near Tokyo.

The contemplated loan will comprise $6-million in a World Bank loan at an annual interest rate of 6% for 15 years, $4-million in Kawasaki Steel to be floated by a syndicate of U.S. life insurance firms (a face value of $100 each at an interest rate of 7.5% and matured in 10 years after being issued), and $2-million in a Hanover Bank loan.

The loan contracts are likely to be simultaneously signed with the World Bank, the life insurance syndicate and Hanover Bank about mid-August. The mill, with a designed production capacity of 600,000 tons a year, is scheduled to be completed in June of next year. Kawasaki received a World Bank loan of $20-million in 1957 and another World Bank loan of $8-million in 1958.

AUSTRALIA

First shipments of Western Australian bauxite to Japan will total 30,000 tons and, if successful, will be followed by large Japanese orders for the material to be mined at Darling Range. It is understood that the W.A. State Government is prepared to authorize imports of about 300,000 tpy. Eventually the Western Australian Government hopes to attract investors to create large-scale alumina industry in that state.

Three gold lodes, spaced some 300 ft apart, have been exposed in the current gold search on Misima Island in Papua. In addition to higher grade structures, large tonnages of lower gold concentrations have been reported. Austral Malay Tin Ltd. is to become a shareholder in the prospecting company, Pacific Island Mines Ltd.

Australia's first customs treatment plant for zinc, lead, copper and silver will be established at Lithgow in New South Wales. Construction of the plant has begun and it will treat ore from various deposits in New South Wales. Lithgow Smelters Pty. Ltd. will be the operating company.

Highest profit since 1942 was earned in 1959 by the West Australian gold producer Sons of Gwalia Ltd. Net earnings of £A30,808 compare with £A41 in 1958. Ore treated was 153,138 (prev. 153,862) tons for a gold recovery of 33,547 (30,296) oz gold. Ore reserves are 237,100 (230,300) tons with an average grade 5.06 (4.89) dwts. The newly com-

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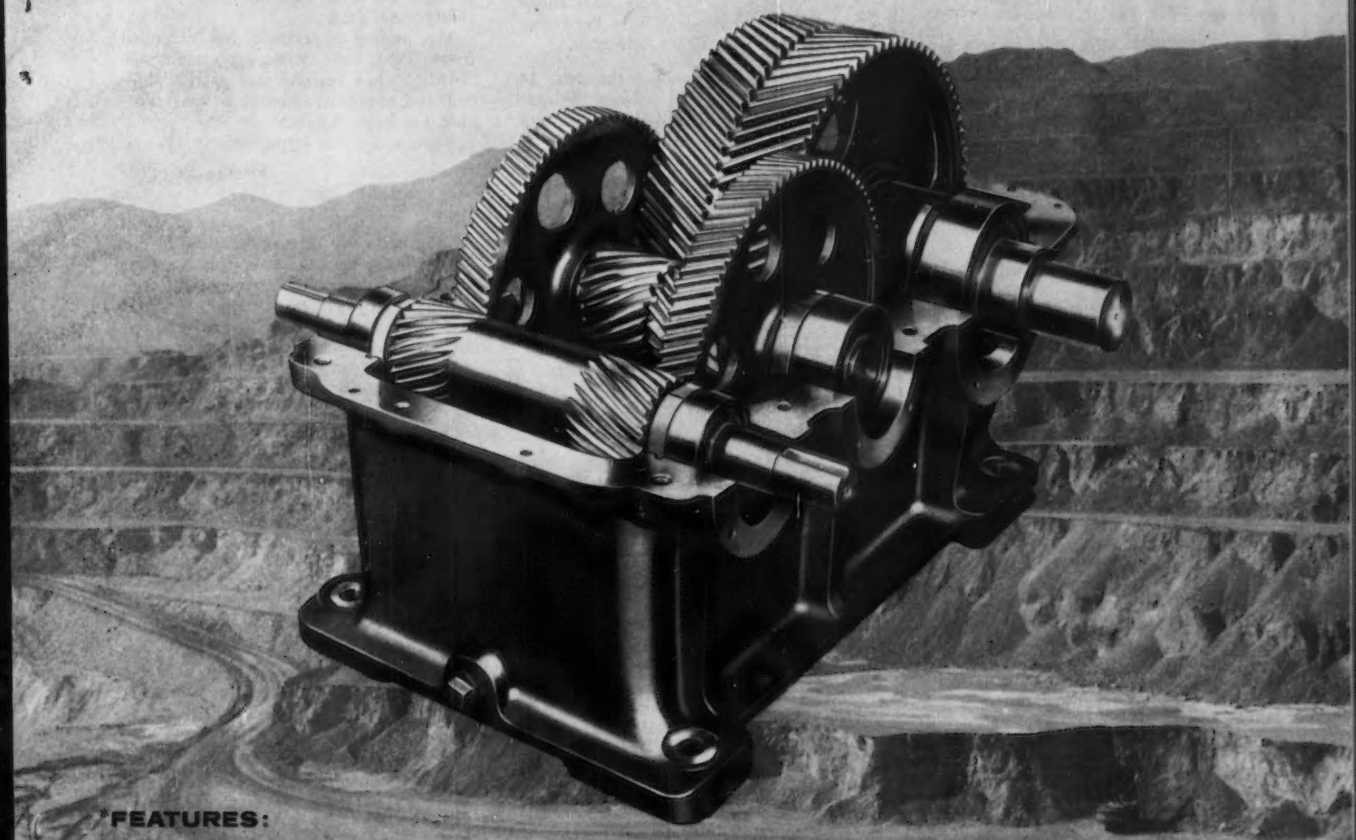

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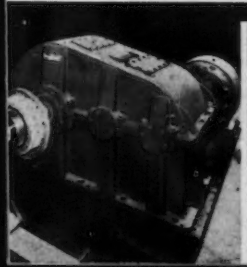

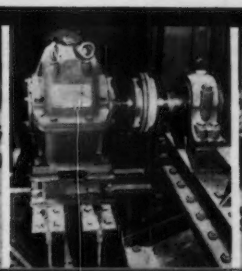

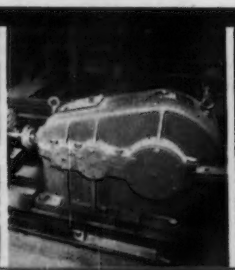

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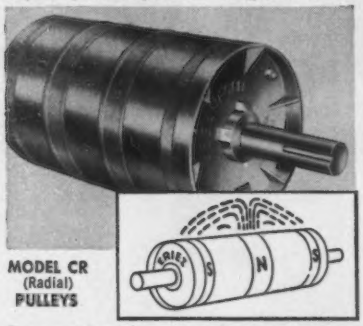

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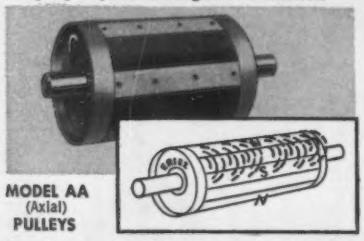

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ERIEZ

Australia *(Continued)*

pleted crusher station reduced production costs considerably.

Both Japanese and Australian experts believe that a token export quota for Western Australian iron ore will be established in the near future. Strong pressure is being exercised on the Federal Government to permit the export of at least 5- to 10-million tons to Japan.

United Uranium N.L. reports that underground work at Coronation Hill has disclosed high gold values in addition to uranium. Very encouraging indications of new uranium deposits have been also reported from the El Sharana area.

Exploratory drilling below the No. 24 level in Morning Star Mines' Woods Point Mine has disclosed a fairly strong reef. Drill intersections at 79 and 99 ft assayed 7.8 and 7.2 dwt respectively. Another Victorian gold producer, A-1 Consol.N.L. is now driving on payable values in its bottom No. 23 level where assays of up to 21 dwt have been reported.

LETTERS

Portable Pension Plan

Dear Sir:

With regard to the May 1960 issue of ENGINEERING & MINING JOURNAL, I would like to indicate my concurrence with the thought that a portable pension plan would be a most useful element in attracting talent to the mining industry. While, in my own experience, I have been able to remain with one organization, I have been in the employ of six separate subsidiaries. Had they not been considered subsidiaries of the parent organization, my background and years would have been of no avail and in each case I would have been starting anew insofar as accrued pension considerations were concerned.

Therefore, I personally have no need for the program you propose. However, I do feel that it is an excellent thought and as a professional member of the mining fraternity I wish to voice my approval of this idea.

Vice President, Mining Company

Dear Sir:

In answer to your editorial "Do We Want a Portable Pension Plan?"—Of course!

I have never understood why mining is still handled like "going to sea" used to be. So I suggest—go ahead, don't wait in lending your editorial support to promote a portable pension plan.

Mining Engineer

Dear Sir:

In regard to your proposed portable pension plan, I am in favor of it.

Mining Engineer

Dear Sir:

In response to your editorial I should like to state that the idea of a portable pension plan is interesting.

It would be my suggestion that your offices serve to explore the idea further, and provide a basis for drawing firm conclusions. At this point not enough information is available to accurately assess the merits or problems involved.

Mine Manager

Dear Sir:

Regarding your editorial "Do We Want a Portable Pension Plan?" I sincerely vote YES.

My mining experience has extended from 1931, but with advancing age "rustlin'" has become increasingly difficult and economic conditions less favorable for large families.

Thanks for this opportunity.

Mining Engineer

Dear Sir:

I regret to say that at this time in my life I am *not* opposed to a portable plan for mining engineers. As a young man and for many years thereafter, I would have been opposed to such an idea, believing, in my simple way, that "rugged individualism, my faith in making my way successfully no matter how rough the going was, and my competence to manage my own affairs" (to paraphrase

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In an ordinary cyclone dust re-circulates in the double-eddy currents at the top, finer dust escapes. The result is erosion of the walls of the cyclone and loss of efficiency. In the Buell cyclone (as shown in the cutaway illustration) the dust at the top makes less than one revolution before it is trapped by the "Shave-Off". It is then channeled down to the lower portion of the cyclone, well below the clean gas outlet. Result: longer life for the cyclones, plus higher collection efficiency.

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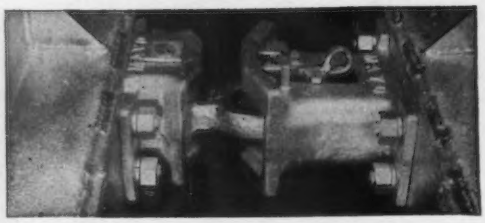

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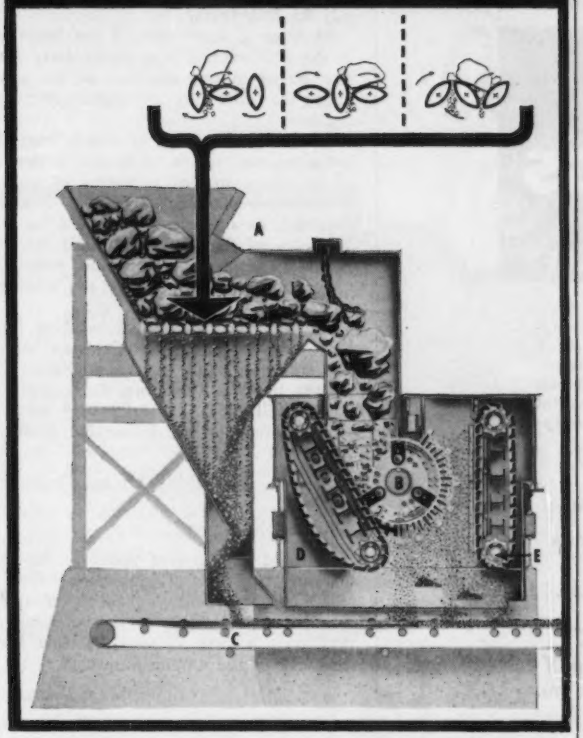

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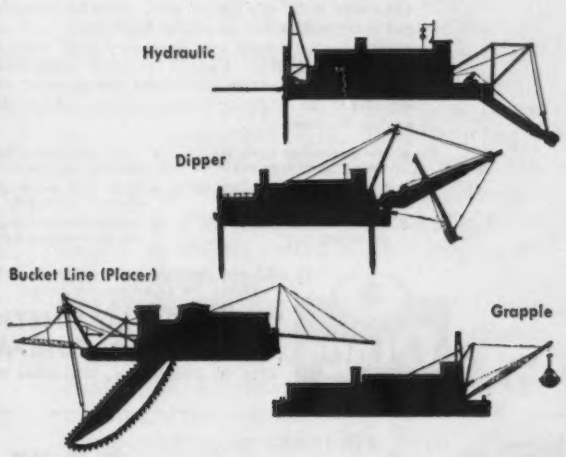

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a portion of your editorial) would see me through. It did. I am now retired after having followed my profession happily for fifty years.

Now as a wiser man, I am heartily in favor of such a plan particularly for any young mining engineer or for any young man who may contemplate becoming one.

The time has arrived in which "rugged individualism" seems to have lost much of its virtue in this economy of ours. While competence in one's work is still required, as of course it should be, a modicum of financial safety and return should, and could, be made possible under the portable plan for the mining engineer.

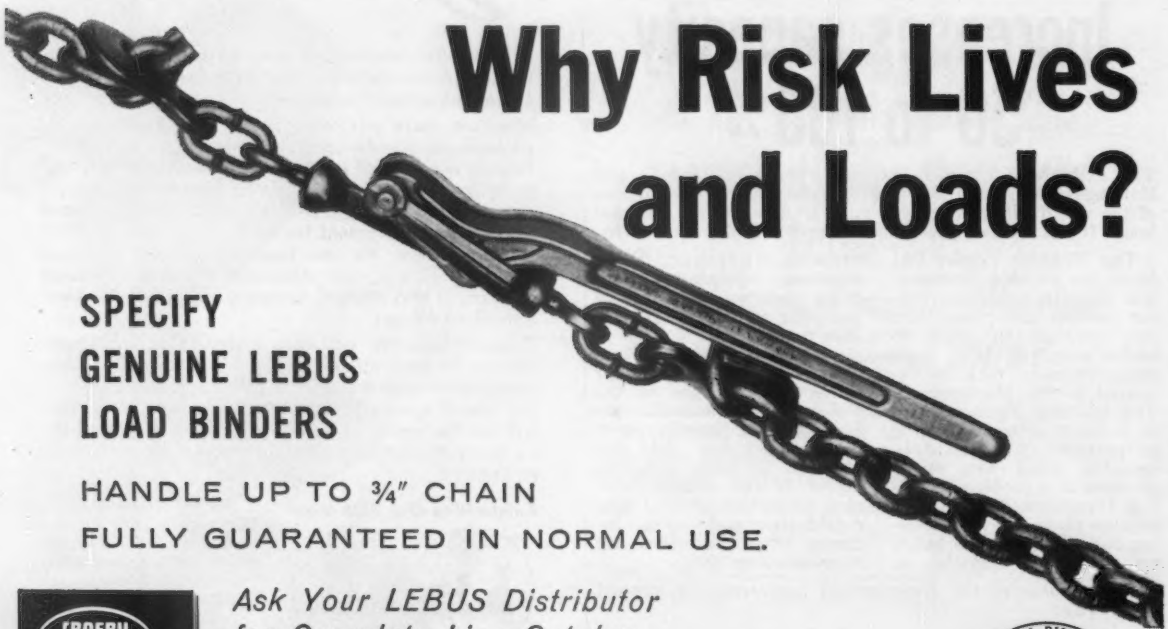
As you said in your editorial in the May issue of the ENGINEERING & MINING JOURNAL "the cards are stacked against him" at this time. Such a plan should add attraction to a very necessary, interesting, and honorable profession.

Consulting Mining Engineer

Dear Sir:

I would like to give you my support to your suggestion of promoting editorially a portable pension plan as outlined by Prof. H. R. Rice. It is my opinion that such a plan is long overdue for members of the mining industry.

Mine Manager



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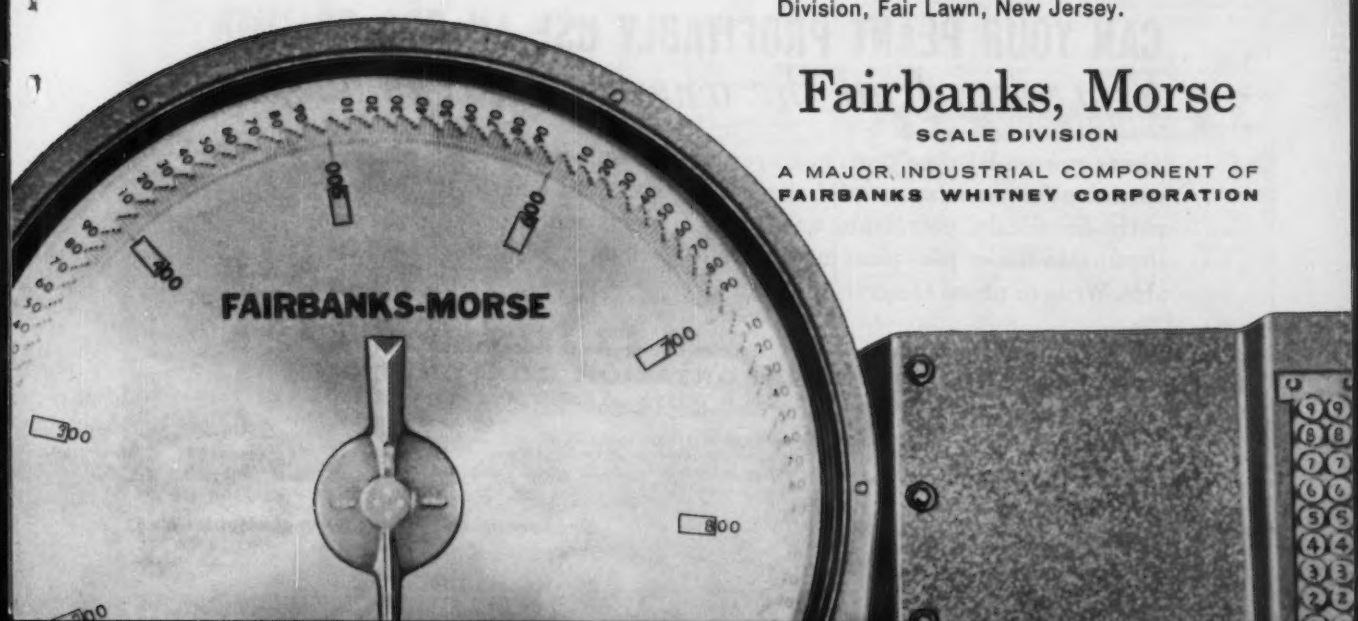

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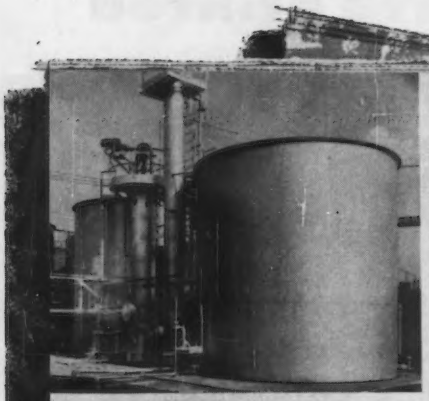

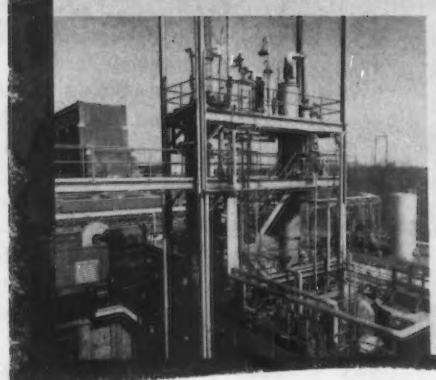

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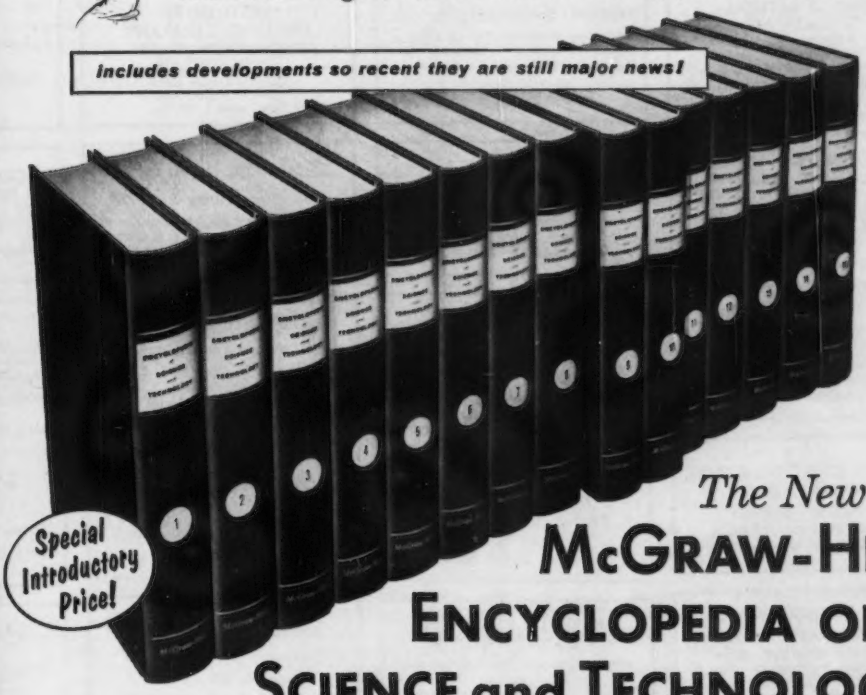

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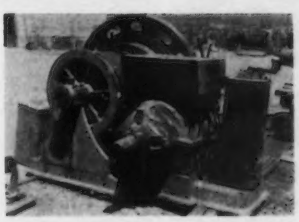

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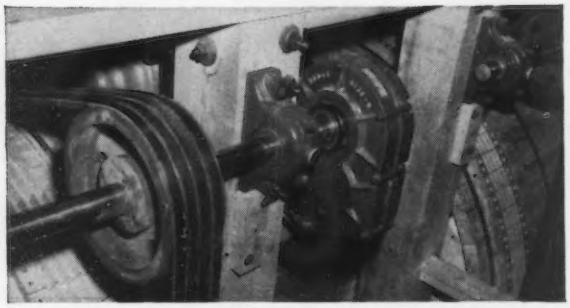
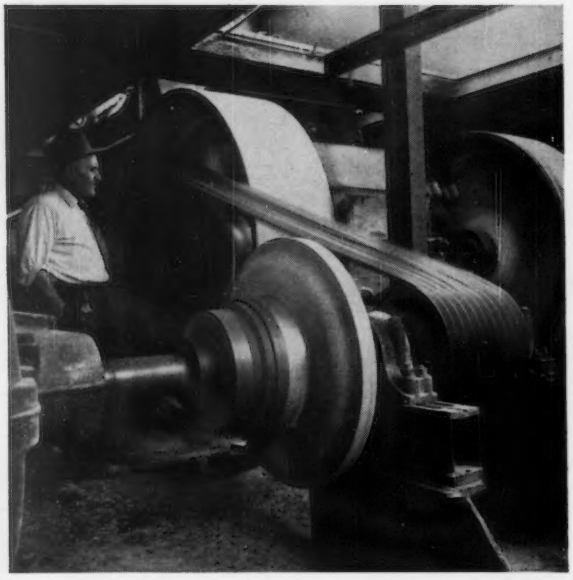
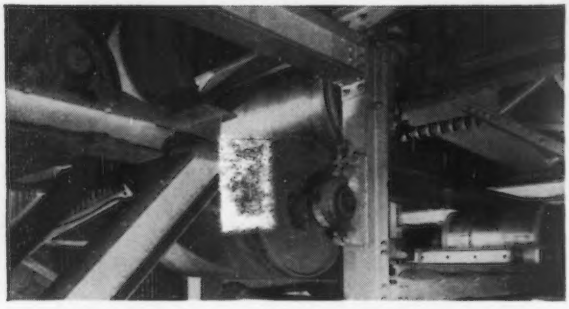
How Dodge pillow blocks with Timken® bearings give longer life with less maintenance



1. Two 2 7/16" Dodge Special Duty pillow blocks equipped with Timken® tapered roller bearings, support the line shaft driving six by eight foot tanning drums. The tapered design of Timken bearings enables them to take both radial and thrust loads in any combination.



2. The crusher at a trap rock and asphalt plant runs faster, gives more production now that Dodge Double Interlock pillow blocks on Timken bearings are installed. The Timken bearings in these blocks give full-line contact between rollers and races for greater load carrying capacity.



3. The Timken bearings in All-Steel Dodge pillow blocks must stand up under adverse operating conditions found when sintering metals. One major advantage of Timken tapered roller bearings is their ability to hold housings and shafts concentric, thus keeping lubricant in, dirt and dust out.

The photo at right shows the Dodge All-Steel pillow block Timken bearing equipped. The specially designed bearing has a tapered bore with self-aligning spherical outer surface—never needs adjustment.

There's a Dodge pillow block equipped with Timken bearings to fill every engineering need: All-Steel, Type "E", Double-Interlock, Type "C" and Special Duty. And with Timken bearings, space consuming thrust devices are not needed. Look for Timken bearings in all the machines you buy or build. They're the symbol of quality. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO". Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits. Canadian Division: Canadian Timken, St. Thomas, Ont.

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